# Baseline Study on the Operational Performance and Threshold Operational Optimisation of 20 Medium to Large-Scale Agro-Processors in Africa

Prepared by:


MazaoPesa™
Community of Successful Agribusiness

Suite 8B Mashiara Business Park,
Loresho, Kaptagat Road, Off Waiyaki Way
Tel: +254721499311
Email: info@mazaopesa.or.ke
https://library.mazaopesa.com/


Submitted to:

Agri-Business Facility for Africa

AUDA-NEPAD
AFRICAN UNION DEVELOPMENT AGENCY


german cooperation
DEUTSCHE ZUSAMMENARBEIT

Co-funded by the European Union

AUDA-NEPAD
AFRICAN UNION DEVELOPMENT AGENCY

Implemented by
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Agri-Business Facility for Africa

# Contents

# Lists of equations, tables and figures

## List of equations



## List of tables

## List of figures

# Acknowledgements

The Consultant and his team are grateful for the financial support provided by GIZ and AUDA-NEPAD to undertake this assignment. The Author and Consultant would like to thank informants, industry experts, agro-processing companies, Agro-Processors Associations, who collaborated and informed this study.

# About this report

This Baseline Study report was conducted to assess the operational performance and threshold operational optimisation of 22 medium to large scale agro-processors in selected Countries in East, West and Southern Africa. The report was conducted by Charles Muigai of Mazao Pesa Ltd and commissioned by AUDA-NEPAD. The report presents the study findings on capacity utilisation and performance of Agro-processing facilities in Dairy, Beef, Maize milling and Cashew nuts covering Kenya, Malawi, Ghana, and Nigeria. The report is intended as a knowledge tool and information source for development agents, investors, lenders and other interested parties. Charles Muigai is an Agro-processing and Value Chains Expert and lead this study.

# Disclaimer

# Acronyms

| | |
|---|---|
| AfCFTA | African Continental Free Trade Area |
| CGSs | Credit guarantee schemes |
| CMA | Cereal Millers Association |
| CNSL | Cashew nuts shell liquid |
| CUR | Capacity utilisation rate |
| FIFO | First in first out |
| FPOs | Promoting farmer-producer organisations |
| FMCG | Fast moving consumer goods |
| FMN | Flour Mills of Nigeria |
| FOB | Free on board |
| GDP | Gross domestic product |
| HACCP | Hazard analysis and critical control point |
| ICT | Information and communication technology |
| ISO | International Standards Organization |
| KBHC | Kenya Bureau of Halal Certification |
| MGF | Matching Grant Fund |
| NGOs | Non-governmental organisations |
| OEE | Overall equipment effectiveness |
| PEF | Pulsed electric field technology |
| PPE | Personal protective equipment |
| RCN | Raw cashew nuts |
| SACCO | Savings and Credit Cooperative Organization |
| SEC | Specific energy consumption |
| SIETTA | Salon International de l'Équipement, des Technologies et des Services de l'Anacarde |
| SME | Small and medium-sized enterprise |
| SUPKEM | Supreme Council of Kenya Muslims |
| TPM | Total productive maintenance |
| TQM | Total quality management |
| WCM | World class manufacturing |

# Executive summary

This report presents baseline findings of 'the Operational Performance of 22 medium to large-scale African agro-processors' firms in Kenya, Malawi, Ghana, and Nigeria, focusing on dairy, beef, maize milling, and cashew nuts sectors. The survey examined how effectively these companies utilise their installed processing capacity, identifying bottlenecks and potential improvements to enhance efficiency. The survey results indicate average capacity utilisation in 22 agro-processing firms across Kenya, Malawi, Ghana, and Nigeria, as follows:

**Table 1: Category and average actual capacity utilization**

| Value chain | Category and average actual capacity utilisation | |
|---|---|---|
| | Large | Medium |
| Dairy processing | 58% | 38% |
| Maize milling | 62% | 52% |
| Beef meat processing | 39% | 40% |
| Cashew nuts processing | 34% | 40% |

Factors contributing to this performance include limited access to raw materials, technological constraints, and supply chain challenges. While an ideal utilisation rate is 100%, practical constraints, such as maintenance, setup time, interdependencies, and demand variability, often hinder achieving this goal. Capacity utilisation is a multifaceted concept that encompasses efficiency, strategic foresight, cost management, technological advancements, risk mitigation, environmental sustainability, and human capital. It requires a holistic approach involving data-driven decision-making and continuous improvement. High capacity utilisation reflects efficient operations leading to increased output and lower unit costs, while low utilisation suggests inadequate raw materials, inefficiencies, and potential financial losses. This metric is crucial for agro-processors seeking to enhance production, optimise costs, and minimise waste, allowing them to offer competitive pricing. A thorough understanding of these elements is vital for positioning African countries to strengthen their role in agro-processing and realise the vision of an agro-industrial Africa. This report suggests strategies for improvement to optimise agro-processing capacity utilisation and enhance throughput.

## Findings: Beef meat processing

The survey reveals that beef processing facilities show wide differences in capacity utilisation, with larger firms performing better thanks to their access to both domestic and export markets. However, both medium and large processors face challenges such as poor infrastructure, inconsistent cattle supply, fluctuating meat quality, and highly elastic demand. Technology use is limited, with little automation and no standardised grading, which restricts product differentiation and carcass value maximisation. Medium processors especially struggle with limited access to credit, hindering investment. The study emphasises the need for modernisation, investment in cold chain infrastructure, advanced tools, and comprehensive staff training. It also recommends diversifying products and targeting affordable options for low-income consumers to boost profits and reduce waste. Overall, beef processors in Kenya and Malawi are operating below potential, indicating room for growth and improved efficiency.

### Key recommendations

Proposed interventions for optimisation include:

1. Invest in advanced equipment and collaborate with financial institutions to access resources.
2. Implement tax incentives, such as zero-rated taxes on essential machinery.
3. Promote modern beef cattle fattening models using precision livestock farming technology.
4. Launch consumer education campaigns to increase awareness of beef products and address negative perceptions.
5. Streamline workflows from slaughter to butchery for efficiency and product quality.
6. Explore the use of Pulsed Electric Field (PEF) technology to improve meat processing outcomes.
7. Reform policy frameworks to create a fair, investor-friendly environment and address informal sector competition.
8. Offer comprehensive training through a Beef Processing Masterclass, covering advanced butchery, processing, safety, and business skills.

By focusing on these areas, beef meat processing facilities can improve their capacity utilisation, reduce costs, enhance product quality, minimise their environmental footprint and optimise operations.

## Findings: Maize milling

Medium-size maize milling factories are operating below capacity, mainly due to irregular maize supply, high input costs, and market uncertainties. Large mills are closer to optimal utilisation but still face similar challenges. Some mills have improved output by upgrading equipment and enhancing storage and logistics. Efforts to optimise capacity also include streamlining operations, staff training, and quality control. To further improve, mills will need coordinated sourcing, infrastructure upgrades, and better access to finance for technological advancements, helping them operate more efficiently and meet growing demand.

### Key recommendations

The following interventions and investments can optimise capacity utilisation and optimal performance in maize milling:

1. **Maximising extraction rates** by investing in advanced equipment and using high-quality raw materials, which enhances both capacity and product quality.
2. **Understanding market dynamics** and tailoring production, such as adjusting flour grade and packaging, to meet consumer preferences.
3. **Implementing automation** to streamline operations, boost productivity, and enable better monitoring of production metrics.
4. **Regular maintenance and equipment management** to prevent downtime and ensure optimal functionality.
5. **Optimising milling parameters** (e.g., sieve size, rotor speed, feed rate) to improve throughput, energy efficiency, and product quality.
6. **Adopting energy-efficient practices** and equipment to improve operational efficiency.
7. **Investing in storage capacity** (like silo storage) to mitigate seasonal impacts and ensure consistent capacity utilisation.

8. **A comprehensive maize milling masterclass**, covering essential processing steps, operational efficiency, quality control, and food safety, emphasising the importance of skilled operators and best practices in the industry.

By implementing these interventions, maize millers can significantly improve their capacity utilisation, enhance efficiency, and maximise profitability.

## Findings: Dairy processing

The survey found that dairy processing factories in the surveyed countries struggle with low capacity utilisation – sometimes as low as 50-60% in Kenya – mainly due to inconsistent milk supply, quality problems, and competition from informal sellers and imports. Key barriers include poor infrastructure, unreliable electricity, and a lack of cold storage, along with high production and labour costs. Medium-sized processors face added challenges from limited finances and outdated technology. The informal sector further intensifies competition and undermines regulated processors. The report recommends investing in better infrastructure and stronger partnerships between farmers and processors. Cooperative models, particularly those used in Kenya, are identified as effective strategies to support smallholder farmers and improve dairy plant performance in countries like Ghana, Malawi, and Nigeria.

### Key recommendations

The following interventions and investments can optimise capacity utilisation and optimal performance in dairy processing:

1. Consistent supply of high-quality raw milk is crucial for maximising dairy processing capacity.
2. Collaboration with farmers and adoption of cooperative models enhance supply reliability, collective bargaining, and investment.
3. Contract manufacturing and co-packing can utilise excess capacity and open new market opportunities but require standardised procedures and strong supply chains.
4. Efficient inventory management and alignment with market demand are essential to minimise losses and disruptions.
5. Adoption of energy- and water-efficient technologies improves operational efficiency and sustainability.
6. Comprehensive workforce planning, including optimal staffing and training, is key to maintaining productivity.
7. Transitioning to 24/7 operations and synchronising production with supply chains reduce downtime and boost capacity utilisation.
8. Real-time monitoring systems and industry collaboration support proactive adjustments and waste reduction.
9. Market development and product diversification (e.g., cheese, yogurt) expand demand and make better use of facilities.
10. Infrastructure challenges (e.g., poor roads, limited storage) and regulatory policies (pricing, market access) significantly impact operations.
11. A Dairy Processing Masterclass is recommended to provide technical and business skills across all stages of the industry.

# Findings: Cashew processing

Cashew processing plants in Nigeria and Ghana are significantly underutilised, with many operating at only 20% of their capacity. Key obstacles include limited access to raw cashew nuts, inadequate financing, and higher costs compared to Asian competitors. Other issues such as short harvest seasons, outdated processing methods, poor infrastructure, and lack of skilled workers also hinder productivity. The survey recommends policy reforms, technological upgrades, improved supply chains, and stronger marketing to increase efficiency and boost capacity utilisation.

### Key recommendations

The survey identified the following recommendations for increasing the capacity utilisation of cashew processing plants:

1. **Policy and collaboration:** Develop tailored policies to promote domestic cashew processing and coordinate stakeholders – including government, research, and industry – to drive efficient capacity use.
2. **Contract and toll processing:** Encourage outsourcing of processing and packaging, allowing brands to expand without heavy investment, and enabling processors to serve broader markets.
3. **Farmer support:** Provide farmers with quality seedlings, training, and market access to increase raw cashew nut supply and improve production quality.
4. **Infrastructure:** Enhance rural infrastructure, especially roads, to reduce transport costs and ensure timely delivery of raw materials to processing plants.
5. **Financial support:** Improve access to affordable loans and financial instruments, de-risk investments, and create tailored loan products for the sector's unique needs.
6. **Byproduct and product diversification:** Promote the use of cashew byproducts (like apples and shells) and diversify products to reduce waste and increase profitability.
7. **Market access:** Support technical skill development and improve access to market information to boost efficiency and create greater market demand.
8. **Quality and traceability:** Establish strong quality standards and transparent supply chains to reduce defects and meet international requirements.
9. **Training:** Offer comprehensive training through programs like the Cashew Processing Masterclass, which covers the full value chain from production to market and quality management.

Continued strengthening of the cashew value chain is achievable by addressing the challenges faced by processors and enhancing their capacity. This approach can lead to increased production, improved utilisation of processing capacity, and ultimately generate greater economic benefits for all stakeholders.

In conclusion the survey results reveals that to optimise Africa's agro-processing sector will require collaboration across the supply chain, adoption of resource-efficient technologies, and strong policy support. Integrating stakeholders improves supply chain resilience and product quality, while innovative technologies reduce costs and optimise resources. Strengthening links between agriculture and processing, supporting local equipment, and better demand forecasting enhance capacity utilisation. Policy measures encouraging investment and market access are also vital. Together, these actions can significantly boost the sector's performance and competitiveness.

# 1.0 Introduction

## 1.1 Background and contextual analysis

Agriculture is a major contributor to Africa's economy, making up nearly a quarter of its GDP and supporting most households. Despite this, limited agro-processing means raw materials are often exported and then re-imported as expensive finished products. Nonetheless, the sector shows promise due to rising demand for processed foods, urban growth, and increasing investment, even though it faces challenges related to infrastructure and financing. The African Continental Free Trade Area (AfCFTA) aims to promote domestic processing and reduce reliance on imports, aligning with broader goals like the Africa 2063 Agenda. By harnessing its young workforce and abundant resources, Africa can add more value, create jobs, and strengthen its role in the agricultural value chain. Overcoming obstacles such as insufficient raw materials, limited technology, poor infrastructure, and a shortage of skilled labour is essential to unlock the agro-processing sector's full potential. In agro-processing, capacity utilisation is a key performance indicator that gauges the operational efficiency and effectiveness of agro-processors in today's market. High utilisation indicates strong demand and efficient production, while low levels may suggest supply chain problems or weak market demand. Tracking this metric helps agro-processors and policymakers make informed decisions to optimise resource use and boost profitability.

This Baseline study reports the assessment of operational performance and threshold operational optimisation of 22 medium to large-scale agro-processors in selected Countries in East, West, and Southern Africa. The study report will support the GIZ-ABF competitive Matching Grant Fund (MGF) with further baseline information and monitoring data, which will be instrumental in providing technical advice and effective implementation of projects in the Maize, Livestock, and Cashew nuts value chains. Information on the operational levels of agro-processors will further support the identification and implementation of interventions in these value chains.

## 1.2 Africa's agro-processing opportunity

Africa is poised for substantial growth in the agro-processing sector, with projections indicating a potential market of $1 trillion by 2030. This surge is attributed to a rapidly growing population, heightened demand for processed foods, and a wealth of raw agricultural resources. By advancing the agro-processing industry, Africa can drive industrialisation, create employment opportunities, and improve food security throughout the region. Key features of Africa's agro-processing environment include:

1. **Growing demand:** The expanding African population and urbanisation are increasing the demand for processed foods.
2. **Untapped potential:** Africa has vast, uncultivated arable land, presenting significant opportunities for agricultural growth and agro-processing.
3. **Infrastructure gaps:** Inadequate storage, transportation, and processing facilities lead to post-harvest losses, highlighting investment opportunities in agro-processing.
4. **Access to finance:** Limited financing options for smallholder farmers and agro-processing businesses hinder innovation and technological advancement, affecting overall performance.
5. **Inadequate quality infrastructure:** Ensuring the quality and safety of processed foods is vital for consumer confidence and market competitiveness.

6. **Opportunities for value addition:** Agro-processing can enhance raw agricultural products' value, generate jobs, increase farmer incomes, and drive economic growth.
7. **Policy and regulatory framework:** Government intervention is essential for fostering a supportive environment for agro-processing through incentives, infrastructure, and finance.
8. **Impact on food security:** A strong agro-processing sector can enhance food security by minimising post-harvest losses and improving food availability.
9. **Sustainable practices:** Implementing sustainable agricultural methods and promoting agro-processing can mitigate climate change and protect the environment.
10. **Centrality of smallholder farmers:** Empowering smallholder farmers and ensuring their market access are crucial to the agro-processing sector's success.

## 1.3 Factors affecting capacity utilisation in agro-processing

Capacity utilisation in agro-processing is influenced by various internal and external factors. Internally, leadership quality and organisation are crucial, while externally, elements like market demand, input availability and pricing, infrastructure, and government policies have a significant impact. These factors can either improve or hinder the efficient use of resources and production capacity. Understanding these dynamics is vital for agro-processors to make informed decisions and enhance their operational efficiency. These factors include:

1. **Market demand:** Capacity utilisation is primarily influenced by product or service demand. High demand leads agro-processors to operate near full capacity, while low demand results in reduced utilisation. Economic downturns can exacerbate this effect.
2. **Production efficiency:** The efficiency of production processes significantly impacts capacity utilisation. Optimised production lines minimise downtime and bottlenecks, enhancing resource utilisation. Inefficient procedures lead to underutilisation.
3. **Technological advancements:** Utilising advanced technology and automation improves capacity utilisation by reducing errors and increasing production speed. For instance, automated packaging machines in food processing enhance efficiency and resource optimisation.
4. **Seasonal variability:** Capacity utilisation is affected by seasonal demand fluctuations. Agro-processors need strategic resource management to avoid overcapacity or underutilisation. Solutions may include diversifying product lines or partnering with other businesses during off-peak seasons.
5. **Supply chain management:** Effective supply chain management is vital for ensuring optimal capacity utilisation, as delays in raw material supply can hinder production and lead to underutilisation. A well-coordinated supply chain ensures a consistent flow of materials, enabling agro-processors to fully utilise their production capacity.
6. **Investment in capacity expansion:** Agro-processors should assess market trends to determine the necessity for capacity expansion, including investments in machinery and infrastructure. Conducting thorough cost-benefit analyses is crucial to identifying the most beneficial investment levels. For instance, a meat processing company might expand its facilities to address increasing demand for beef peptides, thereby enhancing capacity utilisation and seizing market opportunities.


**Figure 1: Factors affecting capacity utilization in agro-processing**

## 1.4 Capacity utilisation and operational efficiency metrics in agro-processing

The definition of the time period used in calculating production capacity can vary, and each method can significantly impact both the capacity level and KPIs such as capacity utilisation and unused capacity cost. To determine the most suitable approach for your business, it is essential to understand these different methods.

1. **Scheduled capacity:** Calculates production capacity based on scheduled working hours, e.g., 16 hours daily (960 minutes) and 80 hours weekly (4,800 minutes) for a two-shift agro-processor.
2. **Maximum potential capacity:** Measures total capacity over a full 24 hours (1,440 minutes) to account for fixed costs. However, relying solely on this method can hinder continuous improvements in non-24/7 operations due to inertia.
3. **Effective machine capacity:** Considers the reduced operational time of machines, which cannot effectively run 24/7 without impacting lifespan and yield. Adjusted calculations can be made using tools like digital twins or AI models, which may suggest 21 effective operational hours (1,260 minutes) per day.
4. **Runtime capacity:** The runtime capacity recognises that not all scheduled time in a day is productive due to necessary downtimes such as worker breaks, machine setup, and cleanups, especially in cGMP-regulated industries. By subtracting these planned idle periods from the total scheduled capacity, the actual effective runtime is calculated. For example, in a factory operating two shifts over 16 hours, the real runtime may drop to 11 hours when accounting for non-productive time. This approach allows agro-processors to improve runtime through lean manufacturing or automation, aligning with Overall Equipment Effectiveness (OEE). However, if OEE is already being tracked, additional monitoring of runtime capacity may not be necessary. Additionally, focusing solely on runtime capacity might distort interpretations of fixed costs over a

24-hour period, affecting cost-benefit analyses. Therefore, operational efficiency metrics are essential for accurately assessing capacity utilisation. Key metrics include:

a. **Overall equipment effectiveness (OEE):** Combines availability, performance, and quality to provide a complete view of manufacturing efficiency. Low OEE points to underused machines, affecting capacity.
b. **Throughput rate:** Measures units produced over time, indicating production bottlenecks. Combined with capacity utilisation analysis, it helps pinpoint areas for improvement.
c. **Ideal cycle time:** Defines the minimum time required to produce one unit under optimal conditions. Analysing average production times helps identify process inefficiencies, while reducing cycle time can enhance capacity utilisation.
d. **Capacity utilisation rate:** Calculated by dividing actual output by potential output, it provides a basic measure of utilisation but should be assessed alongside other metrics for thorough analysis.


**Figure 2: Capacity utilisation and operational efficiency metrics in agro-processing**

## 1.5 Enablers of agro-processing capacity utilisation

Several factors enable increased utilisation of agro-processing capacity. These include access to affordable and reliable raw materials, access to appropriate technologies and infrastructure, availability of skilled labour, access to finance, supportive government policies, and industry collaboration.

### Access to and availability of raw materials

- **Consistent supply:** A reliable and consistent supply of high-quality raw agricultural produce is crucial for efficient agro-processing. This involves addressing seasonal fluctuations, reducing post-harvest losses, and ensuring efficient transportation and storage.
- **Local sourcing:** Utilising locally sourced raw materials can reduce costs associated with transportation and import, making agro-processing more competitive and sustainable.

### Technology and infrastructure

- **Appropriate technologies:** Access to and adoption of suitable technologies for processing, packaging, and storage can significantly enhance efficiency and reduce waste.

- **Infrastructure development:** Investments in transportation networks, power supply, water management, and communication systems are essential for supporting agro-processing activities.
- **Digital technologies:** Cloud computing and other digital solutions can enhance access to information, market connections, and overall efficiency in the agro-processing value chain.

### Skilled labour and human capital

- **Training and capacity building:** Offering training programs to farmers, processors, and other stakeholders on modern production techniques, quality control, and business management is essential.
- **Specialised skills:** Developing a skilled workforce with expertise in areas like food science, engineering, and marketing is crucial for accelerated agro-processing capacity utilisation.

### Access to finance

- **Affordable credit:** Providing access to affordable credit and financial services is essential for agro-processors to invest in technology, infrastructure, and working capital.
- **Targeted finance:** Targeted financial support through microfinance institutions and grant programs can help small and medium-sized agro-processors to expand their operations.

### Supportive policy and regulatory environment

- **Clear regulations:** Streamlined regulations and policies related to food safety, quality standards, and market access can create a more predictable and enabling environment.
- **Government incentives:** Incentives like export bans on export of raw materials, tax breaks, subsidies, and support for research and development can encourage investment and innovation in the agro-processing sector, thus improving capacity utilisation.

### Industry collaboration

- **Farmer organisations and cooperatives:** Promoting the formation of farmer organisations and cooperatives can facilitate collective learning, resource sharing, and smoothen logistics and access to raw materials.
- **Public-private partnerships:** Encouraging collaboration between public and private sector actors can leverage expertise and resources for the benefit of the entire agro-processing value chain.

By focusing on these key enablers, countries can unlock the full potential of agro-processing and bolster capacity utilisation.

## 1.6 Objectives of the study

This survey aimed to fulfil several objectives, enhancing the understanding of the agro-processing landscape and guiding decisions related to capacity utilisation and performance optimisation. The primary goal was to evaluate the performance of agro-processing across selected African countries and value chains. The specific objectives of the survey were to:

1. Assess and compare agro-processing capacity utilisation among selected medium and large-scale firms in Kenya, Malawi, Nigeria, and Ghana.
2. Identify factors affecting capacity utilisation and performance in value chain-specific agro-processor enterprises in the aforementioned countries.
3. Capture key parameters of capacity utilisation and explore potential optimisation strategies.
4. Provide recommendations for value chain and ecosystem improvements to enhance agro-processing capacity utilisation.

## 1.7 Rationale of the study

The study examined the utilisation of agro-processing capacity and ways to enhance performance, aiming to increase food processing output by efficiently utilising resources. It examined current utilisation rates, identified bottlenecks, and proposed strategies to improve efficiency. Boosting capacity utilisation can increase production, cut costs, and boost profits for agro-processing companies. Analysing how capacity is utilised helps identify underutilised or overused resources, enabling companies to make more informed decisions about resource allocation and process improvements. In this survey, capacity utilisation refers to the extent to which a firm's resources, such as equipment, labour, and materials, are utilised to produce output. Two metrics were used;

1. **Capacity utilisation rate (CUR):** Capacity utilisation rate is expressed as a percentage, calculated by dividing actual production output by maximum production capacity. Many businesses target a rate between 80% and 85% for flexibility in handling demand or issues.
2. **Overall equipment effectiveness (OEE):** Overall equipment effectiveness (OEE) measures the percentage of productive time during planned production by evaluating Availability, Performance, and Quality. A benchmark OEE of 85% is considered world-class for discrete manufacturers.

# 2.0 Methodology

## 2.1 Methodology and data collection

A comprehensive assessment of agro-processors' capacity utilisation and optimisation was conducted in Kenya, Malawi, Ghana, and Nigeria from [start date] to [end date] in October 2025. The study employed a multi-faceted methodology that included both primary and secondary data collection, along with qualitative and quantitative data analysis, to evaluate capacity utilisation in the sector. Utilising a case study approach, the survey assessed the operational status of agro-processing facilities, identified factors affecting capacity utilisation, and explored potential strategies for enhancement. Additionally, production data was examined, stakeholders were interviewed, and the overall operational environment was analyzed. Benchmarking was applied to compare different agro-processing facilities, identifying best practices and opportunities for improvement.

The study used a dataset collected from 24 agro-processing firms across Nigeria, Kenya, Malawi, and Ghana, focusing on capacity utilisation parameters and metrics relevant to optimisation and performance. The survey covered medium and large firms across four value chains: dairy, maize milling, meat processing, and cashew nut processing. Both quantitative and qualitative data were gathered through face-to-face interviews with firm managers and owners.

- **Primary data:** Gathered directly from agro-processing companies, emphasising production output, equipment usage, labour hours, and other metrics.
- **Structured questionnaires:** Utilised standardised questionnaires to capture respondents' feedback about capacity utilisation.
- **Capacity utilisation assessment process:** The process involved understanding manufacturing workflows, total installed/design capacity, and actual output to calculate the utilisation rate. Analysis of the utilisation rate identified influencing factors such as demand variability, bottlenecks, and inefficiencies. Overall Equipment Effectiveness (OEE) was used to measure production efficiency by evaluating Availability, Performance, and Quality. Recommendations for improvement included optimising layouts, minimising downtime, enhancing internal processes, and promoting continuous improvement.

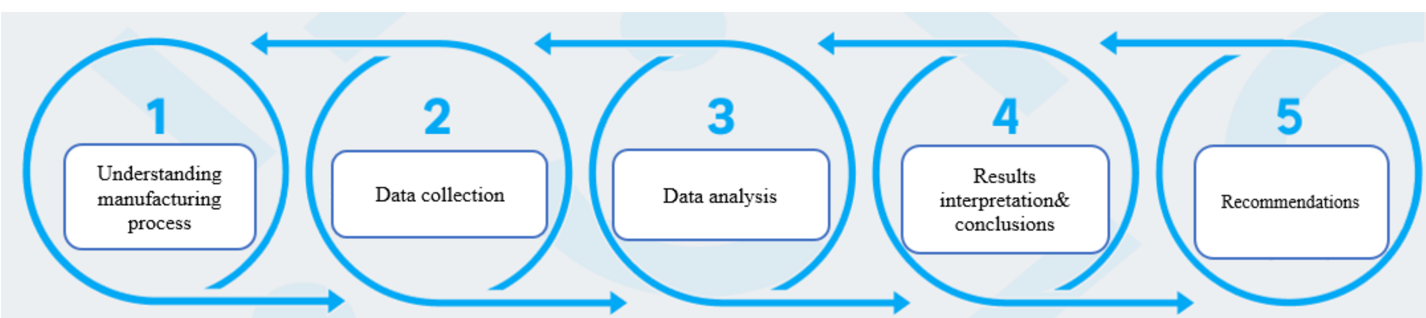



**Figure 3: Capacity utilisation assessment process**

## 2.2 Conceptual framework

Agro-processing firms operate within an ecosystem that includes suppliers, markets, and various stakeholders, all of which contribute to the acquisition of raw materials, internal processing, and market distribution. A solid framework for enhancing capacity utilisation in agro-manufacturing must integrate supply chain management, market systems, sustainability, and digital transformation. It should account for both the physical capabilities of facilities and economic factors affecting production efficiency. Furthermore, leveraging technology is essential for improving capacity utilisation, fostering sustainability, and encouraging collaboration and innovation throughout the supply chain.

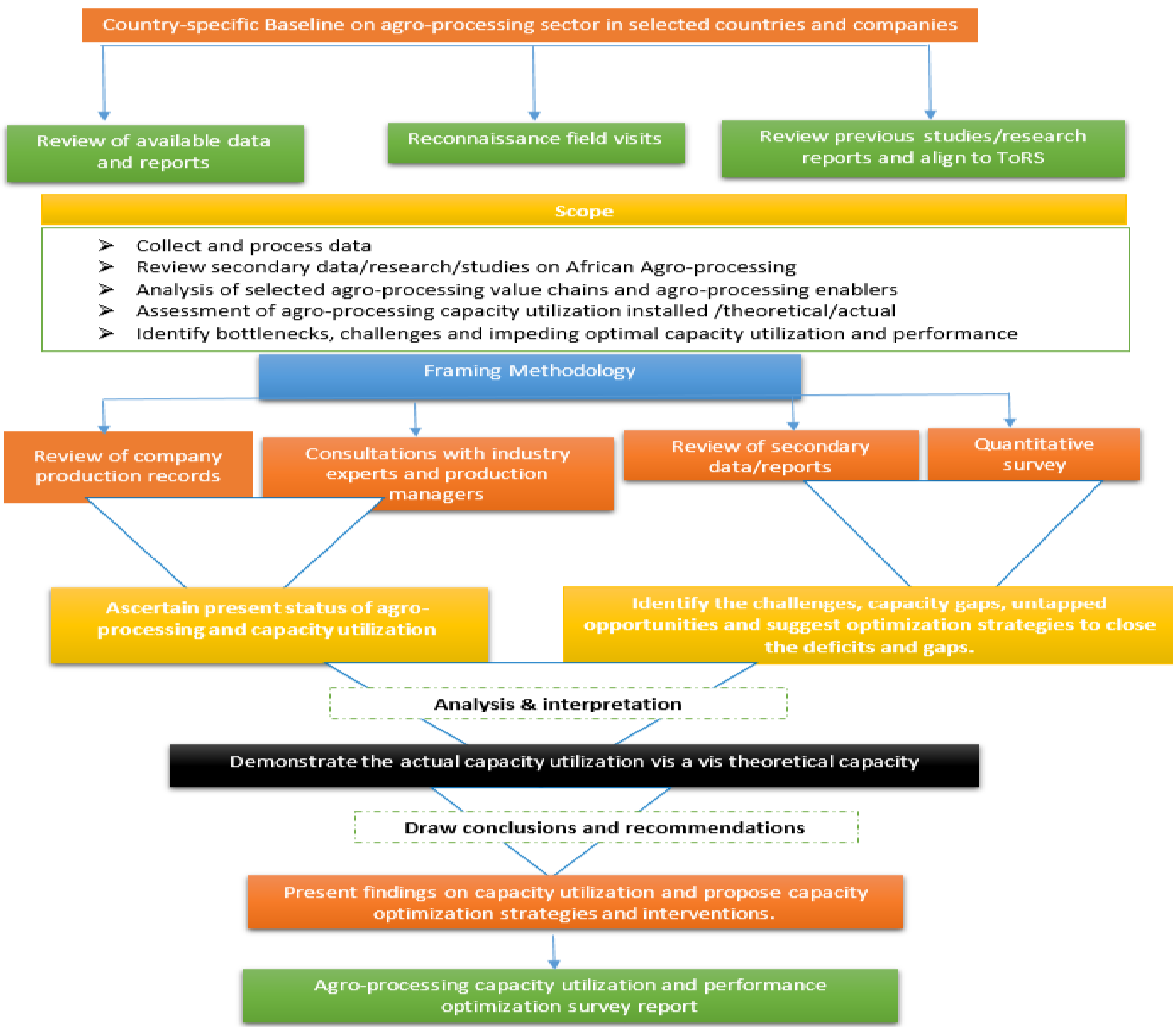



**Figure 4: Conceptual framework – capacity utilisation assessment**

## 2.3 Data sources and description of study respondents

A total of 35 respondents participated in the study, which comprised two categories: core agro-processing actors and those providing facilitative services to these core actors. This approach was designed to gather comprehensive information to achieve the study's objectives.

- **Government statistics:** Government statistics include data from agricultural censuses, industrial surveys, and trade statistics.
- **Industry surveys:** Industry surveys involved collection of data on production capacity, utilisation rates, and challenges from agro-processing firms.
- **Literature review:** this involved academic research and relevant studies on agro-processing capacity utilisation in the region.

The survey sample frame included 24 medium and large-scale agro-processing firms from each participating country.

**Table 2: Sample size and value chains**

| Country | Value chain | Category/Size | | Total |
|---|---|---|---|---|
| | | Medium | Large | |
| 1. Kenya | Maize milling | 1 | 1 | 2 |
| | Beef Meat Processing | 1 | 1 | 2 |
| | Dairy Processing | 1 | 1 | 2 |
| 2. Malawi | Maize milling | 1 | | 2 |
| | Beef Meat Processing | 1 | 1 | 2 |
| | Dairy Processing | 1 | 1 | 2 |
| 3. Ghana | Cashew processing | 1 | | 2 |
| | Maize Milling | 1 | 1 | 2 |
| 4. Nigeria | Cashew processing | 1 | 1 | 2 |
| | Maize milling | 1 | 1 | 2 |
| | Dairy Processing | 1 | 1 | 2 |
| Total | | 11 | 11 | 22 |

## 2.4 Categorisation and scale determination

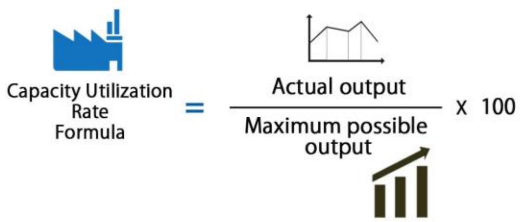
In Africa, agro-processing factories are categorised differently based on size, which varies between countries and value chains. The classifications generally include small-, medium-, and large-scale processing units, but the specific capacity thresholds vary. For example, a cashew processing unit with a capacity of 1,000 MT/year may be classified as small-scale in Ghana but medium-scale elsewhere. In maize milling, mills processing over 30 MT per day are considered large-scale, while those producing between 10 MT and 30 MT are medium, and those below 10 MT are small. In the dairy sector, medium-scale dairies process between 10,000 and 100,000 litres per day, whereas large-scale operations exceed 200,000 litres daily. Large cashew processing plants typically handle more than 20 tons of raw cashew nuts per day, while medium ones manage less. Beef processing plants are categorised by their processing capacities, with medium-scale plants processing 50 to 200 heads of cattle monthly and large-scale ones exceeding 2,000 heads. The categorisation also reflects the level of processing, from basic slaughtering to the production of various beef products.

## 2.5 Data analysis

Data analysis was conducted using capacity utilisation and equipment effectiveness metrics. Historical data provided by production managers allowed for the calculation of annual throughput based on monthly capacity aggregates over the past two years. The study employed capacity utilisation rate and overall equipment effectiveness (OEE) to measure effective capacity utilisation. Results were benchmarked against global standards, utilising specified methods and formulas for the calculations.

### Capacity utilisation rate formula

**Equation 1: Capacity utilisation rate formula**

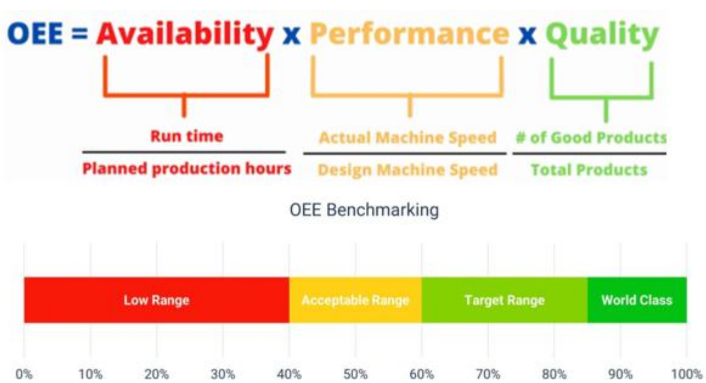



Healthy levels often considered to be between 70% and 85%

### Overall equipment effectiveness[1] (OEE) formula

Overall Equipment Effectiveness (OEE) a metric that measures the percentage of planned production time that is truly productive by evaluating three key factors: Availability, Performance, and Quality.

**Equation 2: Overall equipment effectiveness formula**




While 100% OEE (perfect production) is virtually impossible, achieving scores above 85% signifies near-perfect operational efficiency and is a goal for elite manufacturing operations.

---

[1] Developed by Seiichi Nakajima, Overall Equipment Effectiveness (OEE) is a foundational metric in Lean manufacturing systems used to measure manufacturing efficiency. By tracking availability, performance, and quality, OEE helps identify bottlenecks and waste, enabling targeted improvements.

## 2.6 Survey limitations

This survey has several limitations that highlight the need for further research. It involved a small sample of agro-processing entities across four countries within a two-year timeframe, which may not adequately represent the broader industry. Numerous factors influencing real-world capacity utilisation were beyond the scope of this study, making generalisations difficult. Additionally, the challenge of isolating and quantifying specific factors affecting capacity utilisation restricts the ability to reach definitive conclusions. The following were found to be key limiting factors in this survey:

1. **Data limitations:** Historical data from agro-processor informants was the primary source for capacity throughput analysis, reliant on the source's accuracy.
2. **Incomplete or unavailable data:** Most agro-processors lack comprehensive data on capacity utilisation, leading to potential inaccuracies that obscure root causes of low utilisation. Factory-specific data regarding production activities, equipment performance, and downtime were often incomplete, complicating capacity utilisation assessments.
3. **Inconsistent data formats:** Data from various agro-processors was collected in inconsistent formats, hindering integration and analysis.
4. **Data accuracy issues:** Errors in data entry, measurement discrepancies, and inconsistent reporting practices introduced additional inaccuracies.
5. **Difficulty in isolating variables:** Capacity utilisation is affected by numerous factors such as production planning, equipment maintenance, workforce efficiency, and material availability, making it challenging to isolate the impact of specific variables.
6. **Ethical considerations:**
   - **Informed consent:** Informed consent was obtained from respondents prior to administering the questionnaire.
   - **Confidentiality:** Respondents were assured of the confidentiality of their responses and data.
   - **Data privacy:** To ensure data privacy, code names will be used for surveyed candidates in the final report.

Expanded research is necessary because the current survey only offers a limited snapshot of the situation. Conducting expanded studies could reveal a more representative state of Africa's agro-processing landscape.

# 3.0 Survey findings and discussions

This survey assesses the capacity utilisation and potential performance optimisation within the agro-processing sectors of Kenya, Ghana, Nigeria, and Malawi. An examination of 22 agro-processing plants, focusing on dairy, cashew, maize milling, and beef meat processing, indicated that these firms were operating below their capacity, with the cashew and beef sub-sectors facing the most significant underutilization.

**Table 3: Value chain category and average actual capacity utilization**

| Value Chain | Category and average actual capacity utilization | |
|---|---|---|
| | Large | Medium |
| Dairy Processing | 58% | 38% |
| Maize Milling | 62% | 52% |
| Beef Meat Processing | 39% | 40% |
| Cashew nuts Processing | 34% | 40% |

This underperformance presents substantial opportunities for enhancing production and economic benefit in the sector. Additionally, most of the medium-scale firms, especially cashew, beef and maize milling, reported operating infrequently due to low availability of raw materials and electricity, further contributing to capacity underutilisation.

## 3.1 Agro-processing and the automation transition

The survey indicates that all participating agro-processing companies currently use power-driven machinery in their operations. However, only about half have adopted advanced automation technologies, such as computer-controlled systems and programmable logic controllers. Larger companies are more likely to implement these technologies because they have more financial resources and face higher labour costs, which drive investments in automation. Conversely, smaller firms often face barriers, including limited capital, a lack of skilled labour, and unreliable infrastructure, such as electricity and internet connectivity.

The survey also reveals that access to affordable machinery, availability of spare parts, and the necessity of regular maintenance are key factors influencing technology adoption. Many companies report difficulties in finding skilled workers who can operate and maintain automated equipment, highlighting a gap in technical skills and workforce training. Respondents do not expect automation to eliminate jobs entirely but foresee a shift in the types of roles needed. There will be a greater demand for workers with technical, problem-solving, and digital skills, while the need for low-skilled, repetitive manual labour is expected to decline.

To address these changes, the findings recommend that governments and industry stakeholders invest in targeted tertiary education and training programs, encourage the inclusion of women and other underrepresented groups in technical fields, and implement social protection measures for workers displaced or affected by automation. Strategic planning, resource allocation, and employee upskilling are crucial to ensure that the shift to more automated processes enhances productivity and promotes equal opportunities throughout the agro-processing sector. Before implementing new automation initiatives, the following factors should be carefully considered.

1. **Demand forecasting:** Demand forecasting is essential for determining optimal capacity and automation levels.
2. **Capacity planning:** Agro-processors must create a comprehensive capacity plan that aligns demand with automation capabilities.
3. **Resource allocation:** Effective resource allocation, including human capital and automation technology, is vital for maximising capacity utilisation while preventing employee burnout and overinvestment.
4. **Employee training and development:** Investing in employee training and development is crucial for ensuring effective use of automation and for managing increased capacity demands.
5. **Monitoring and control:** Continuous monitoring of capacity utilisation and performance metrics is necessary to identify areas needing adjustment, while addressing technical challenges such as system reliability and data privacy concerns.

## 3.2 Findings on maize milling

The maize milling industry is diverse, with both small and large mills operating. Key challenges include inconsistent maize supply, high energy costs, infrastructure issues, and maintaining product quality. Strong competition exists, mainly due to regional differences in maize meal grades. Despite these challenges, the sector offers significant opportunities for value addition, technological advancements, food fortification, and job creation. Dry milling primarily produces maize flour, grits for cereals, and snack ingredients, while wet milling yields corn starch, syrups, dextrose, and corn oil, along with animal feed by-products. Mills vary in technology, size, and capital investment; large mills often use advanced roller technology and achieve higher capacity utilisation – especially in countries like Kenya. Conversely, medium-sized mills frequently face low utilisation rates due to inconsistent raw material supply and operational challenges. The market is dominated by a few large companies; however, investments in modernising medium-tier millers, diversifying value-added products, and expanding the market could enhance capacity utilisation and drive growth in the sector.

### 3.2.1 Factors influencing capacity utilisation in maize milling firms

Maize milling companies face major capacity utilisation challenges due to variability in maize supply, high grain prices, increased power costs, and operational inefficiencies. These problems negatively impact profitability, reduce capacity utilisation, and hinder the firms' ability to meet market demand.

*Fluctuating maize supply*

- Dependence on imports exists due to maize supply often falling short of demand, leading to high and inconsistent import costs.
- Regional supply declines are noted, as drought negatively affects local production despite cross-border supplies.
- Cyclical shortages in maize result in millers needing to reduce or cease operations, which affects overall capacity utilisation.

*High costs of inputs*

- **High maize prices:** High maize prices, influenced by supply and other factors, directly affect capacity utilisation.
- **High transport costs:** The cost of transporting maize from farms to mills and from mills to markets adds to the overall expense.
- **Input costs:** Other input costs, such as energy and labour, also contribute to the financial strain on milling operations.

*Operational inefficiencies*

- **Weak quality management:** Some firms, especially the middle tier, struggle with quality control, particularly in fortified maize flour production.
- **Lack of trained personnel:** A shortage of trained mill operators hinders efficient production in the medium-tier category.
- **Regulatory compliance:** Government policies, such as maize meal fortification regulations, can add to the complexity of operations.
- **Inconsistent electricity supply:** Interrupted power supply disrupts milling processes and affects production output.

*External factors*

- **Competition:** The competitive landscape in the maize milling industry can influence production levels as mills adjust to market conditions. Competition from other milling firms, including those with private brands, impact market share, profitability and overall capacity utilisation rate.
- **Consumer preferences:** Shifting consumer preferences and demand for different types of maize products can also influence production decisions including investment in different modules and equipment.
- **Climate change:** Climate change and variability affect maize production, impacting the availability of raw materials for milling.
- **Government policy:** Maize is a strategic crop influenced by government policies. Regulations on its marketing, trade, imports, exports, and fortification can affect availability, milling operations, production processes, and costs.

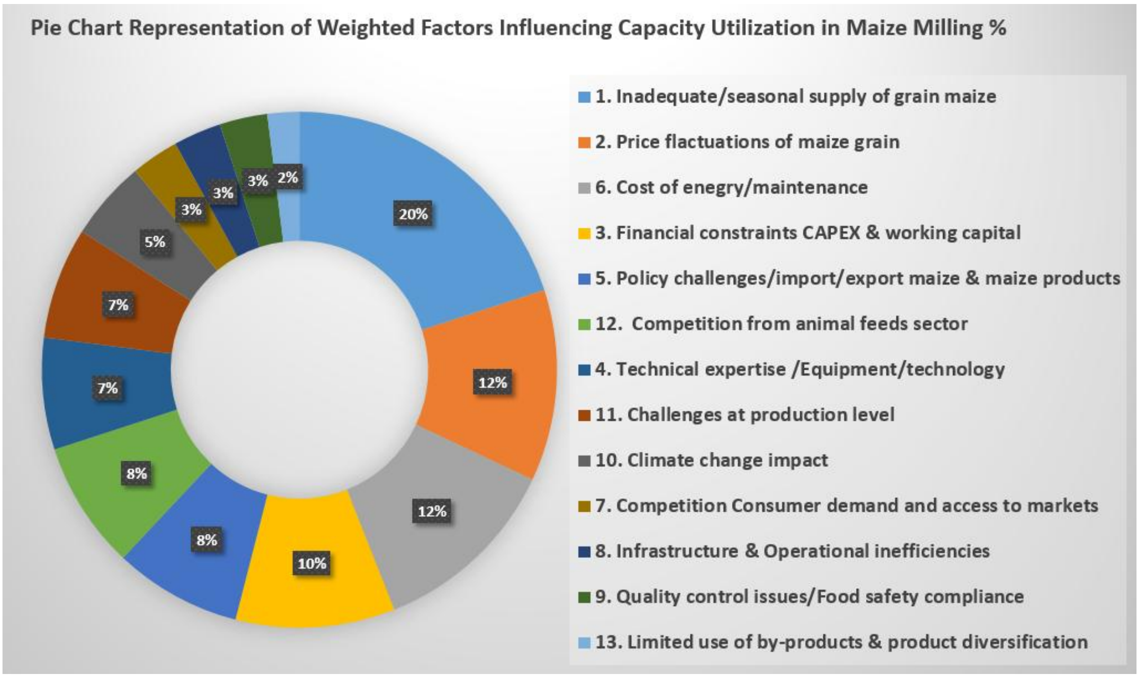



**Figure 5: Weighted factors influencing capacity utilisation in maize milling firms**

## 3.3 Maize milling in Kenya

The maize milling industry in Kenya is a vital component of the country's food system and economy, as maize flour is a staple in most Kenyan households. The sector is composed of two main segments: large-scale to medium industrial mills and small-scale posho mills. Major millers, such as Unga Group, Mombasa Maize Millers, and Pembe Flour Mills, operate sophisticated facilities in urban centres like Nairobi, Mombasa, Kisumu, and Nakuru, producing refined maize flour for both local consumption and export. In parallel, a network of small-scale posho mills provides affordable whole-grain maize flour to rural and peri-urban communities. The sector is characterised by intense competition, fluctuating maize prices, and frequent government interventions – such as price controls and strategic grain reserves – to ensure food security. Millers are also required to meet regulatory standards for food safety and fortification, adding to operational costs but improving public health outcomes. Despite its strengths, the industry faces ongoing challenges, including unreliable maize production due to weather variability, post-harvest losses, high energy costs, and limited access to affordable credit for smaller and medium operators. Investment in modern technology, improved storage, and logistics infrastructure is gradually transforming the sector, leading to greater efficiency and product diversification. As Kenya's population continues to grow, the maize milling industry is adapting by expanding capacity, embracing innovation, and navigating regulatory changes to maintain its central role in the nation's food landscape.

### 3.3.1 Maize Milling Case Study #001@ke – large-scale

*Case Study #001@ke – large-scale*, established in 2011, has ascended to become one of Kenya's leading millers by scale, catering to both the national market and cross-border clients throughout East Africa. Originally focused on maize and wheat flour milling, the company has since expanded into the production of animal feed. It is particularly recognised for its flagship maize meal flour brands. The miller is located in Kirinyaga County, Kenya and has an installed capacity of 625 tons per day.

**Table 4: Annual throughput year 2023 & 2024 – Maize Milling Case Study #001@ke – large-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (MT/month) | Actual intake(MT /months) | Utilization rate (%) | Month | Installed/Design capacity (MT/month) | Actual intake(MT /Month | Utilization rate (%) |
| Jan | 18,750 | 11,500 | 61 | Jan | 18,750 | 12,700 | 68 |
| Feb | 18,750 | 11,500 | 61 | Feb | 18,750 | 12,500 | 67 |
| March | 18,750 | 12,000 | 64 | March | 18,750 | 13,000 | 69 |
| April | 18,750 | 14,400 | 77 | April | 18,750 | 15,400 | 82 |
| May | 18,750 | 15,230 | 81 | May | 18,750 | 15,230 | 81 |
| June | 18,750 | 15,400 | 82 | June | 18,750 | 16,400 | 87 |
| July | 18,750 | 14,500 | 77 | July | 18,750 | 16,500 | 88 |
| August | 18,750 | 14,800 | 79 | August | 18,750 | 15,800 | 84 |
| September | 18,750 | 14,500 | 77 | September | 18,750 | 13,000 | 69 |
| October | 18,750 | 14,700 | 78 | October | 18,750 | 12,400 | 66 |
| November | 18,750 | 13,400 | 71 | November | 18,750 | 12,300 | 66 |
| December | 18,750 | 12,600 | 67 | December | 18,750 | 13,400 | 71 |
| Total | 225,000 | 164,530 | 73 | Total | 225,000 | 168,630 | 75 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =73%

Year 2024 =75%

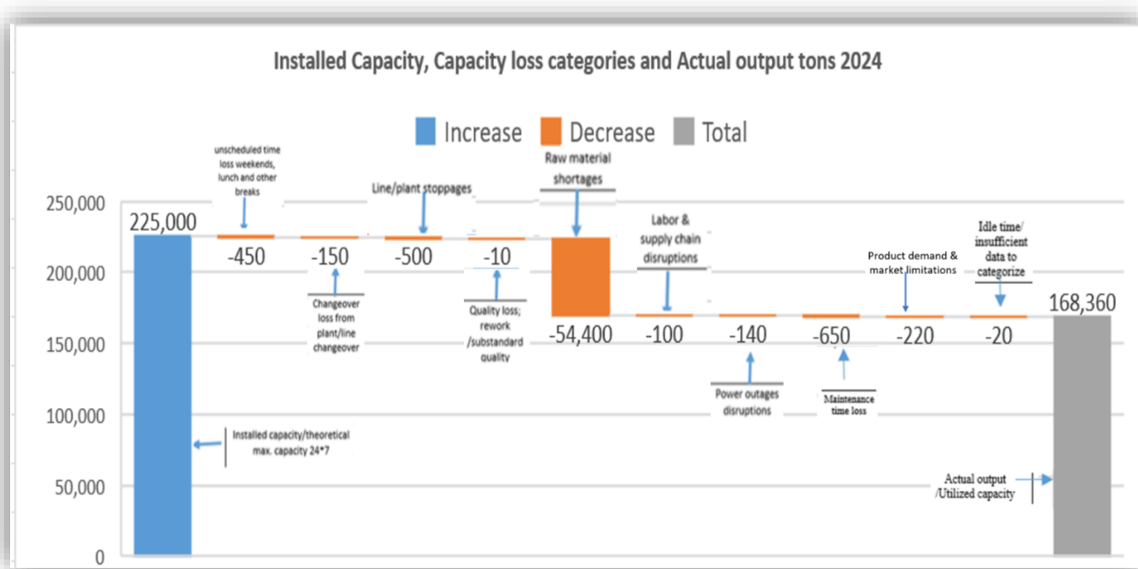



**Figure 6: Capacity utilisation and loss analysis 2024 – Maize Milling Case Study #001@ke – large-scale**

*Overall equipment effectiveness analysis*

At M*aize Milling Case Study #001@ke – large-scale*, quality losses were reported at 1% of productive time within a 16 hour' net run time 6 days a week. From the data collected and analysed, the OEE performance for *Case Study #001@ke – large-scale* in the Year 2024 was reported as follows:

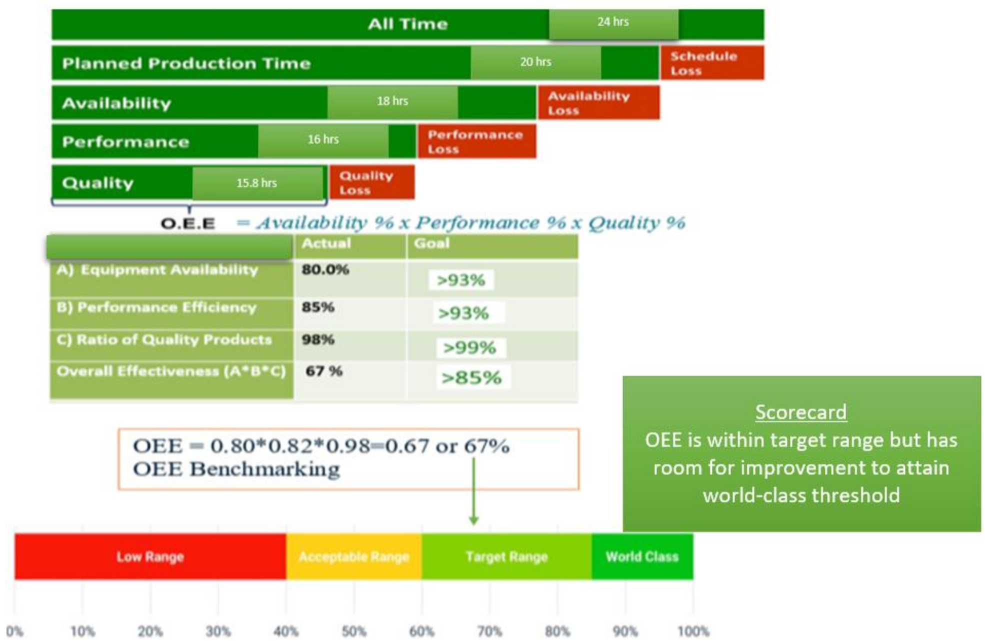



**Figure 7: Overall equipment effectiveness analysis – Maize Milling Case Study #001@ke – large-scale**

*Conclusive findings*

Capacity utilisation measures the efficiency of the production process by factoring in both productive and non-productive time, while Overall Equipment Effectiveness (OEE) focuses on equipment efficiency during scheduled production. OEE targets the "six big losses," which have a significant impact on capacity utilisation. At *Maize Milling Case Study #001@ke – large-scale*, the capacity utilisation rate for 2024 was reported at 75%, with an OEE of 67%, which indicates an 18-point gap to reach the world-class OEE benchmark of 85%. This gap highlights the potential for optimising existing resources and equipment without additional capital investment. By concentrating on minimising losses in availability, performance, and quality, OEE can further enhance actual output and increase operational capacity.

### 3.3.2 Maize Milling Case Study #002@ke – medium-scale

*Case Study #002@ke – medium-scale* is a medium scale maize meal processor with and an installed capacity of 18000MT situated in Sagana Kirinyaga County in Kenya. The company has a full-scale milling and storage operations in 5 acres' facility.

**Table 5: Annual throughput year 2023 & 2024 – Maize Milling Case Study #002@ke – medium-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (MT/month) | Actual intake(MT /months) | Utilization rate (%) | Month | Installed/Design capacity (MT/month) | Actual intake(MT/Month | Utilization rate (%) |
| Jan | 1,500 | 710 | 47.33 | Jan | 1,500 | 780 | 52.00 |
| Feb | 1,500 | 730 | 48.67 | Feb | 1,500 | 722 | 48.13 |
| March | 1,500 | 750 | 50.00 | March | 1,500 | 650 | 43.33 |
| April | 1,500 | 550 | 36.67 | April | 1,500 | 590 | 39.33 |
| May | 1,500 | 650 | 43.33 | May | 1,500 | 600 | 40.00 |
| June | 1,500 | 750 | 50.00 | June | 1,500 | 580 | 38.67 |
| July | 1,500 | 480 | 32.00 | July | 1,500 | 550 | 36.67 |
| August | 1,500 | 550 | 36.67 | August | 1,500 | 730 | 48.67 |
| September | 1,500 | 750 | 50.00 | September | 1,500 | 800 | 53.33 |
| October | 1,500 | 800 | 53.33 | October | 1,500 | 870 | 58.00 |
| November | 1,500 | 850 | 56.67 | November | 1,500 | 750 | 50.00 |
| December | 1,500 | 650 | 43.33 | December | 1,500 | 680 | 45.33 |
| Total | 18,000 | 8,220 | 45.67 | Total | 18,000 | 8,302 | 46.12 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =45.7%

Year 2024 =46%

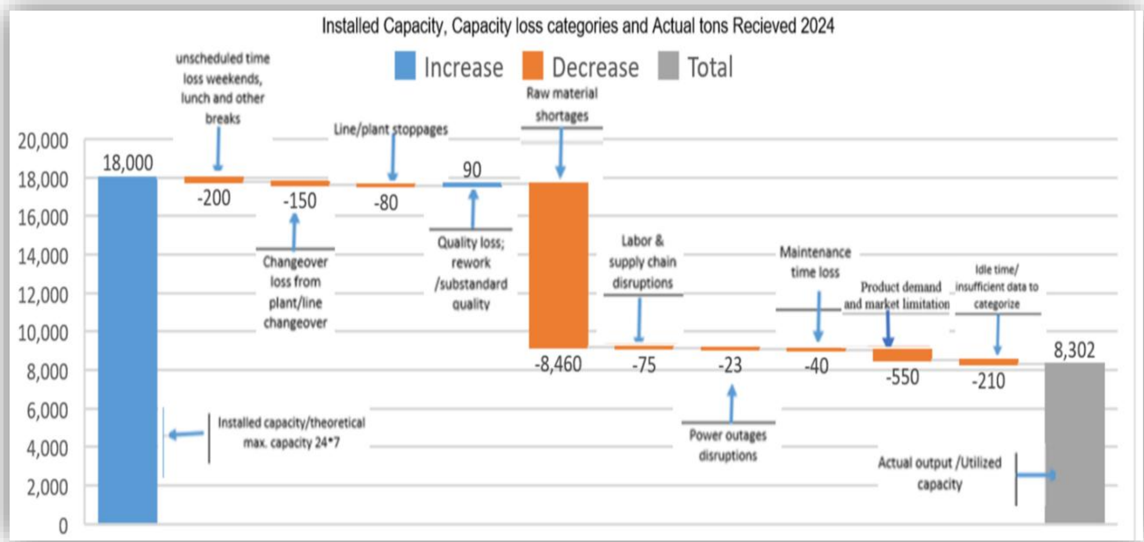



**Figure 8: Capacity utilisation and loss analysis 2024 – Maize Milling Case Study #002@ke – medium-scale**

*Overall equipment effectiveness analysis*

At *Maize Milling Case Study #002@ke – medium-scale*, quality losses were reported at 2% of productive time within 8 hours' net run time, 6 days a week. From the data collected and analysed, the OEE performance for the company in the Year 2024 was reported as follows:

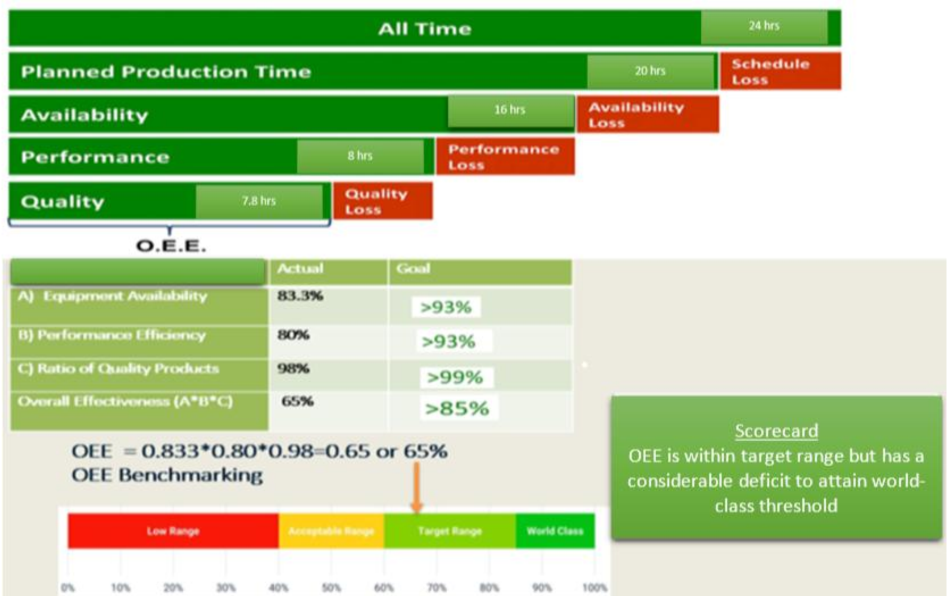



**Figure 9: Overall equipment effectiveness analysis – Maize Milling Case Study #002@ke – medium-scale**

*Conclusive findings*

For C*ase Study #002@ke – medium-scale*, the capacity utilisation rate for 2024 was reported at 46%, with an OEE of 65%. This shows a 20-point gap to reach the world-class OEE benchmark of 85%, highlighting opportunities to optimise resources and equipment. By focusing on acquiring adequate raw materials, capacity utilisation can improve while reducing losses in availability, performance, and quality. The company can improve OEE and hence increase actual output and optimal performance.

### 3.3.3 Conclusion: Maize milling in Kenya

The maize milling industry in Kenya plays a critical role in ensuring the country's food security, with large-scale roller mills dominating the commercial landscape. The sector is undergoing significant transformation as it adopts advanced technologies, pursues sustainability, and strengthens compliance with fortification regulations. Despite these positive trends, challenges persist, particularly in the areas of fortification compliance among small and medium-sized mills, and the ongoing problem of post-harvest losses – especially due to aflatoxin contamination. Looking ahead, industry growth will depend on the widespread adoption of modern milling technology, the development of robust farmer-miller partnerships to improve maize drying and storage, and the consistent enforcement of quality control and food fortification standards. Collaboration between government, regulatory agencies like the Kenya Bureau of Standards (KEBS), and industry stakeholders will be essential, as will targeted training for mill operators. Addressing these challenges will help the industry meet the nation's growing food needs and public health goals.

## 3.4 Maize milling in Malawi

In Malawi, various maize milling machines are used, ranging from traditional stone mills to advanced roller mills, supporting both small-scale, medium and large-scale maize milling operations. The milling process involves several steps: cleaning, conditioning, degermination, milling, and sifting, culminating in the production of maize flour or meal. Major milling companies in the country include Sungold Food Processing Ltd, Rab Processors Ltd, and Sipri Mills Ltd. Notably, Bakresa Milling Company in Blantyre ceased operations a decade ago due to insufficient raw material supply.

### 3.4.1 Maize Milling Case Study #001@mw – large-scale

*Maize Milling Case Study #001@mw – large-scale* was founded in 1983 and is a leading agro-processing company in Malawi. The company specialises in manufacturing and distributing fast-moving consumer goods (FMCG) and collects agricultural produce from farmers. With over 85 outlets across the country, it operates a factory in the Kanengo area of Lilongwe that includes a processing plant, warehouse, and administrative building on a one-acre site, along with a 200-acre maize farm. The factory can mill between 5,000 and 7,500 metric tons of maize each month, producing products such as maize grits, flour, fortified maize meal, and maize germ for animal feed. Its annual production capacity totals 120,000 metric tons.

**Table 6: Annual throughput year 2023 & 2024 – Maize Milling Case Study #001@mw – large-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (MT/month) | Actual Output (MT /months) | Utilization rate (%) | Month | Installed/Design capacity (MT/month) | Actual Output (MT/Month | Utilization rate (%) |
| Jan | 10,000 | 7,200 | 72.00 | Jan | 10,000 | 7,400 | 74.00 |
| Feb | 10,000 | 7,350 | 73.50 | Feb | 10,000 | 7,250 | 72.50 |
| March | 10,000 | 7,400 | 74.00 | March | 10,000 | 7,150 | 71.50 |
| April | 10,000 | 7,500 | 75.00 | April | 10,000 | 7,260 | 72.60 |
| May | 10,000 | 6,500 | 65.00 | May | 10,000 | 7,440 | 74.40 |
| June | 10,000 | 5,500 | 55.00 | June | 10,000 | 7,590 | 75.90 |
| July | 10,000 | 5,800 | 58.00 | July | 10,000 | 7,650 | 76.50 |
| August | 10,000 | 5,700 | 57.00 | August | 10,000 | 7,580 | 75.80 |
| September | 10,000 | 7,000 | 70.00 | September | 10,000 | 7,900 | 79.00 |
| October | 10,000 | 7,200 | 72.00 | October | 10,000 | 7,750 | 77.50 |
| November | 10,000 | 7,500 | 75.00 | November | 10,000 | 7,890 | 78.90 |
| December | 10,000 | 7,500 | 75.00 | December | 10,000 | 7,500 | 75.00 |
| Total | 120,000 | 82,150 | 68.46 | Total | 120,000 | 82,460 | 68.72 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =68.46%

Year 2024 =68.72%

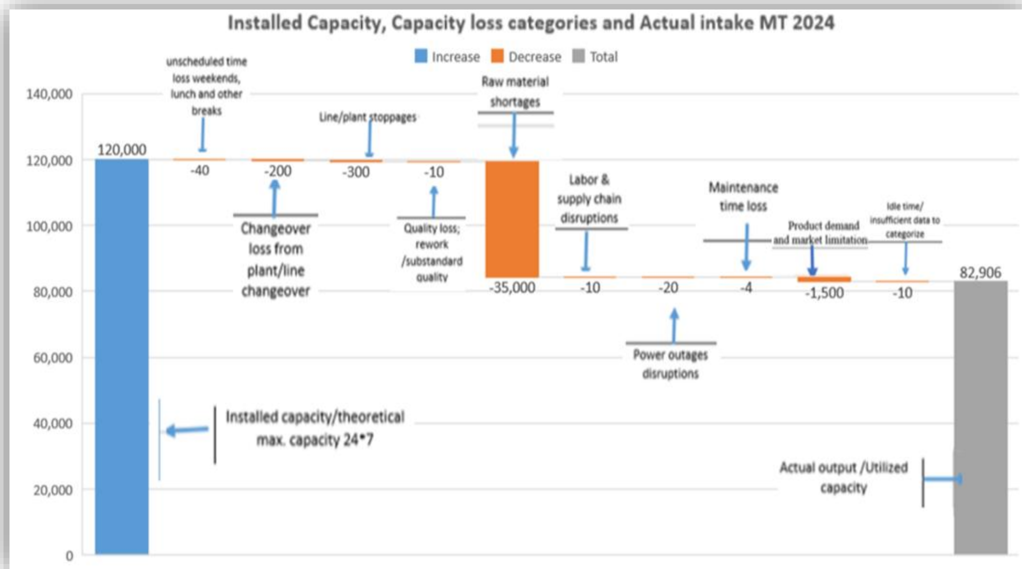



**Figure 10: Capacity utilisation and loss analysis 2024 – Maize Milling Case Study #001@mw – large-scale**

*Overall equipment effectiveness analysis*

At *Case Study #001@mw – large-scale*, quality losses were reported at 3% of productive time within 16 hours' net run time 6 days a week. From the data collected and analysed the OEE performance for the company in the Year 2024 was reported as follows:

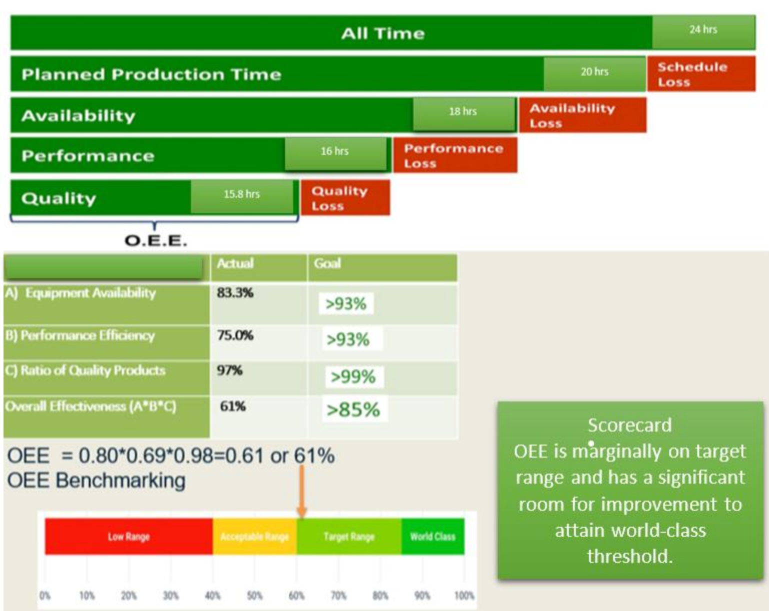



**Figure 11: Overall equipment effectiveness analysis 2024 – Maize Milling Case Study #001@mw – large-scale**

*Conclusive case findings*

Capacity utilisation is a key indicator of production efficiency, considering both productive and non-productive time. OEE (Overall Equipment Effectiveness) evaluates equipment efficiency during scheduled production, whereas capacity utilisation assesses potential productivity, taking into account both scheduled and unscheduled downtime. OEE identifies and aims to minimise the "six big losses" that impair capacity utilisation. High capacity utilisation signals frequent machine operation, but OEE assesses effective operation. Enhancing OEE can release additional capacity by reducing losses, thus increasing output without any new investments in machinery, particularly when utilisation is already high. For instance, *Case Study #001@mw – large-scale* can optimise both metrics to improve operations. In 2024, the company reported a capacity utilisation rate of 69% and an OEE of 61%, indicating that it has a 24-point gap to reach a world-class OEE of 85%, suggesting there is considerable scope for optimisation based on existing capabilities.

### 3.4.2 Maize Milling Case Study #002@mw – medium-scale

*Maize Milling Case Study #002@mw – medium-scale* is a storage and milling company located in Lilongwe, operating since October 2023. It is subcontracted by a brewing company to mill maize and sorghum into flour for brewing. The company runs one 8-hour shift, six days a week.

**Table 7: Annual throughput year 2023 & 2024 – Maize Milling Case Study #002@mw – medium-scale**

| Year 2023/24 | | | | Year 2024/25 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (tons/month) | Actual Output (tons /months) | Utilization rate (%) | Month | Installed/Design capacity (Tons/month) | Actual Output (tons /months) | Utilization rate (%) |
| October | 100 | 60 | 60.00 | October | 100 | 75 | 75.00 |
| November | 100 | 55 | 55.00 | November | 100 | 70 | 70.00 |
| December | 100 | 44 | 44.00 | December | 100 | 65 | 65.00 |
| Jan | 100 | 50 | 0.00 | Jan | 100 | 70 | 70.00 |
| Feb | 100 | 55 | 55.00 | Feb | 100 | 60 | 60.00 |
| March | 100 | 60 | 60.00 | March | 100 | 60 | 60.00 |
| April | 100 | 55 | 55.00 | April | 100 | 60 | 60.00 |
| May | 100 | 48 | 48.00 | May | 100 | 60 | 60.00 |
| June | 100 | 57 | 57.00 | June | 100 | 70 | 70.00 |
| July | 100 | 66 | 66.00 | July | 100 | 65 | 65.00 |
| August | 100 | 65 | 65.00 | August | 100 | 70 | 70.00 |
| September | 100 | 70 | 70.00 | September | 100 | 70 | 70.00 |
| Total | 1,200 | 685 | 57.08 | Total | 1,200 | 725 | 60.42 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =57.08%

Year 2024 =60.42%

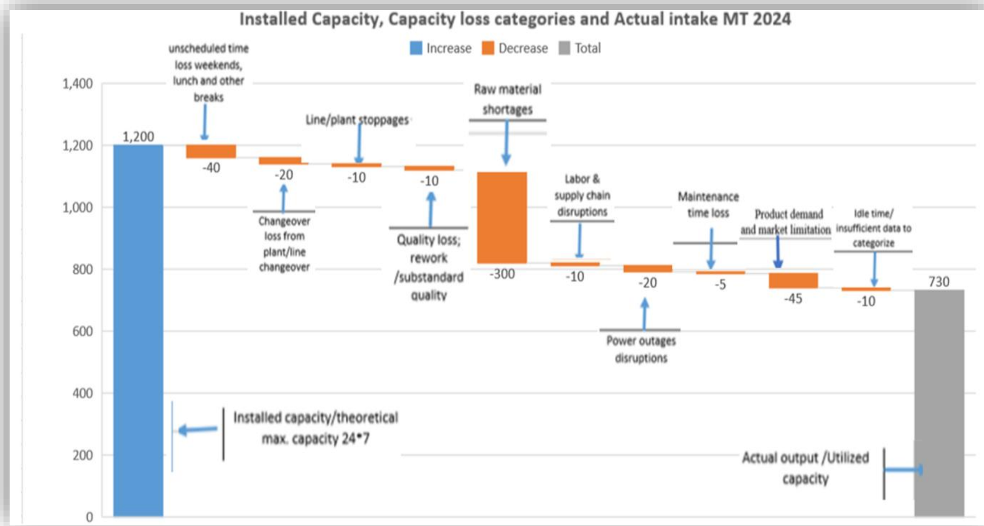



**Figure 12: Capacity utilisation and loss analysis 2024 – Maize Milling Case Study #002@mw – medium-scale**

*Overall equipment effectiveness analysis*

At *Case Study #002@mw – medium-scale*, quality losses were reported at 1% of productive time within 8 hours' net run time 6 days a week. From the data collected and analysed the OEE performance of the company in the Year 2024 was reported as follows:

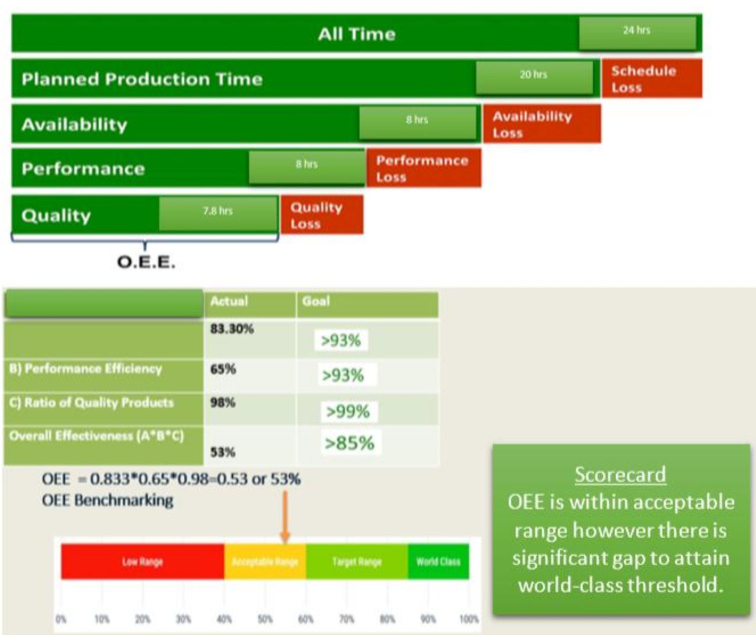



**Figure 13: Overall equipment effectiveness analysis 2024 – Maize Milling Case Study #002@mw – medium-scale**

*Conclusive case findings*

Capacity utilisation is a critical metric that illustrates the efficiency of the production process by accounting for both productive and non-productive time. OEE serves as a diagnostic tool to identify and mitigate the "six big losses" affecting capacity utilisation – breakdowns, setup/adjustments, idling/minor stops, reduced speed, defects, and startup rejects. High capacity utilisation suggests frequent machine operation, while OEE provides insight into its effectiveness. Enhancing OEE can release additional capacity, allowing for increased production without the need for new machinery, particularly in scenarios of already high utilisation. For *Case Study #002@mw – medium-scale*, the capacity utilisation for 2024 was reported at 60%, while OEE stood at 53%. This performance indicates a gap of 32 points to achieve the world-class OEE benchmark of 85%, suggesting there is 'hidden capacity' that could be optimised within the existing operational framework and resources.

### 3.4.3 Conclusion: Maize milling in Malawi

Maize milling in Malawi operates at low capacity utilisation, primarily due to cyclical maize supply shortages that force both large and small-scale millers to cut operations or close down. The survey highlights that maize milling is vital for food security in Malawi but faces challenges such as significant micronutrient loss during refining, weak enforcement of mandatory flour fortification, and strong consumer preference for refined flour over whole maize flour. Although local maize varieties are favoured for their taste and storability, improved varieties are valued for their higher yields. To address these issues, the survey suggests promoting the consumption of whole maize flour, improving dehulling technologies, strengthening regulatory compliance within the milling sector, and increasing investment in modern milling machinery. Overcoming consumer preferences and closing data gaps in the sector are also identified as key steps to enhance both nutritional outcomes and overall productivity.

## 3.5 Maize milling in Nigeria

Nigeria is a major maize producer in Sub-Saharan Africa, with about 10 million tons produced annually and accounting for 9% of the continent's maize supply. This staple is essential in the Nigerian diet and is used in various products, such as bread and cornflakes. The maize milling sector is essential, as it converts maize into flour, grits, bran, and germ for use in food and animal feed. However, the industry faces challenges, including unreliable electricity, high production costs, and limited transportation networks that hinder rural farmers' access to markets. Additionally, local milling companies struggle to compete with cheaper imported maize products. Leading players in Nigeria's maize milling market include Flour Mills of Nigeria (FMN), Northern Nigeria Flour Mills (NNFM), Honeywell Flour Mills PLC, Bendel Feed and Flour Mill Ltd., as well as Pokobros Food & Chemical Industries Ltd and Port Harcourt Flour Mills Ltd.

### 3.5.1 Maize Milling Case Study #001@ng – large-scale

*Maize Milling Case Study #001@ng – large-scale* founded in 1960, is a major publicly listed food and agro-allied company. The company has a combined capacity of 600,000 metric tons and processes about 850 tons of maize daily into various products, including maize grits and fortified meal for animal feed. The company produces products such as Masaflour and Masavita for distribution across Nigeria.

**Table 8: Annual throughput year 2023 & 2024 – Maize Milling Case Study #001@ng – large-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (MT/month) | Actual intake(MT /months) | Utilization rate (%) | Month | Installed/Design capacity (MT/month) | Actual intake(MT/Month | Utilization rate (%) |
| Jan | 50,000 | 20,000 | 40.00 | Jan | 50,000 | 25,400 | 50.80 |
| Feb | 50,000 | 22,500 | 45.00 | Feb | 50,000 | 25,610 | 51.22 |
| March | 50,000 | 20,000 | 40.00 | March | 50,000 | 27,500 | 55.00 |
| April | 50,000 | 20,400 | 40.80 | April | 50,000 | 30,000 | 60.00 |
| May | 50,000 | 20,230 | 40.46 | May | 50,000 | 28,900 | 57.80 |
| June | 50,000 | 21,400 | 42.80 | June | 50,000 | 27,590 | 55.18 |
| July | 50,000 | 22,500 | 45.00 | July | 50,000 | 28,650 | 57.30 |
| August | 50,000 | 22,800 | 45.60 | August | 50,000 | 29,450 | 58.90 |
| September | 50,000 | 19,500 | 39.00 | September | 50,000 | 27,900 | 55.80 |
| October | 50,000 | 20,700 | 41.40 | October | 50,000 | 29,750 | 59.50 |
| November | 50,000 | 22,400 | 44.80 | November | 50,000 | 30,890 | 61.78 |
| December | 50,000 | 21,600 | 43.20 | December | 50,000 | 29,500 | 59.00 |
| Total | 600,000 | 254,030 | 42.34 | Total | 600,000 | 313,240 | 52.21 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =42.34%

Year 2024 =52.2%

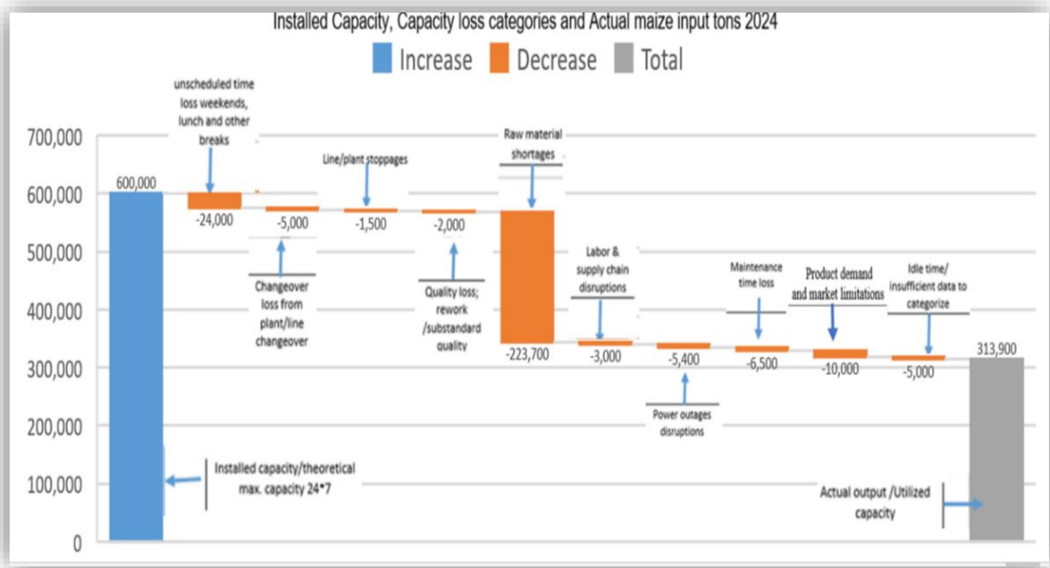



**Figure 14: Capacity utilisation and loss analysis 2024 – Maize Milling Case Study #001@ng – large-scale**

*Overall equipment effectiveness analysis*

At C*ase Study #001@ng – large-scale*, quality losses were reported at 2% of productive time within 8 hours' net run time 6 days a week. From the data collected and analysed, the OEE performance for the company in the Year 2024 was reported as follows:

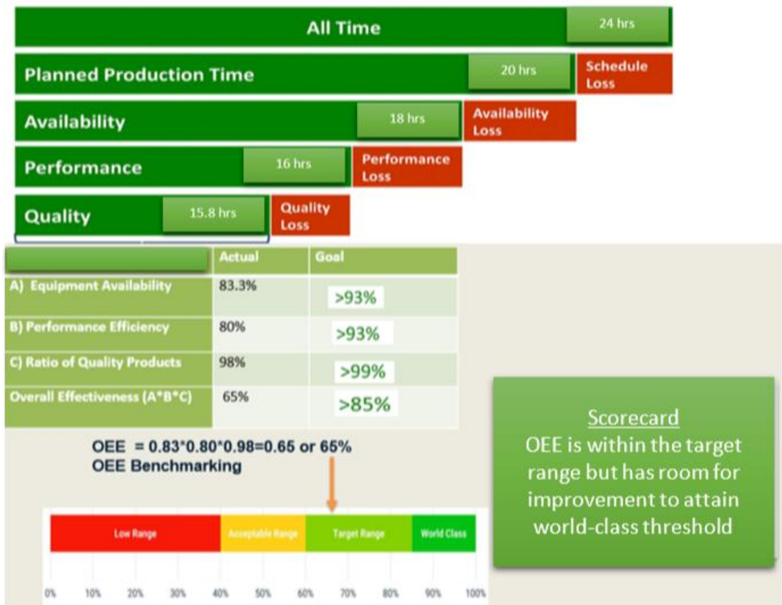



**Figure 15: Overall equipment effectiveness analysis 2024- Maize Milling Case Study #001@ng – Large-scale**

*Conclusive case findings*

Capacity utilisation is a key measure of production efficiency, as it reflects both productive and non-productive time. While Overall Equipment Effectiveness (OEE) assesses the efficiency of equipment during scheduled production, capacity utilisation encompasses the total potential of equipment, factoring in both scheduled and unscheduled downtime. OEE serves as a diagnostic tool to uncover and minimise the "six big losses," which negatively affect capacity utilisation. For *Case Study #001@ng – large-scale*, the capacity utilisation rate for 2024 was reported at 60%, with an OEE of 65%. This indicates that the company has a gap of 20 points to reach the world-class OEE benchmark of 85%. Improvement in OEE could reveal hidden capacity and optimise current resources, thereby enhancing overall operational performance.

### 3.5.2 Maize Milling Case Study #002ng – medium-scale

*Maize milling Case #002ng – medium-scale* is a prominent food and beverage company in Africa, has been serving Nigerian consumers with high-quality nutritious products for over 57 years. Its maize milling division has an annual capacity of 30,000 metric tons but currently averages a throughput of 18,000 metric tons, primarily focusing on breakfast cereals for the mass market. However, the company confronts significant challenges related to the quality and availability of grain maize. Despite these difficulties, a strong network of dedicated suppliers supports contracted farmers, and there is substantial demand for the products, indicating potential for increased capacity utilization.

**Table 9: Annual throughput year 2023 & 2024 – Maize Milling Case Study #002@ng – medium-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (MT/month) | Actual intake(MT /months) | Utilization rate (%) | Month | Installed/Design capacity (MT/month) | Actual intake(MT/ Month | Utilization rate (%) |
| Jan | 2,500 | 1,450 | 58.00 | Jan | 2,500 | 1,500 | 60.00 |
| Feb | 2,500 | 1,500 | 60.00 | Feb | 2,500 | 1,400 | 56.00 |
| March | 2,500 | 1,400 | 56.00 | March | 2,500 | 1,300 | 52.00 |
| April | 2,500 | 1,300 | 52.00 | April | 2,500 | 1,300 | 52.00 |
| May | 2,500 | 1,450 | 58.00 | May | 2,500 | 1,450 | 58.00 |
| June | 2,500 | 1,500 | 60.00 | June | 2,500 | 1,500 | 60.00 |
| July | 2,500 | 1,450 | 58.00 | July | 2,500 | 1,400 | 56.00 |
| August | 2,500 | 1,500 | 60.00 | August | 2,500 | 1,300 | 52.00 |
| September | 2,500 | 1,400 | 56.00 | September | 2,500 | 1,450 | 58.00 |
| October | 2,500 | 1,300 | 52.00 | October | 2,500 | 1,500 | 60.00 |
| November | 2,500 | 1,450 | 58.00 | November | 2,500 | 1,450 | 58.00 |
| December | 2,500 | 1,500 | 60.00 | December | 2,500 | 1,500 | 60.00 |
| Total | 30,000 | 17,200 | 57.33 | Total | 30,000 | 15,600 | 52.00 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =57%

Year 2024 =52%

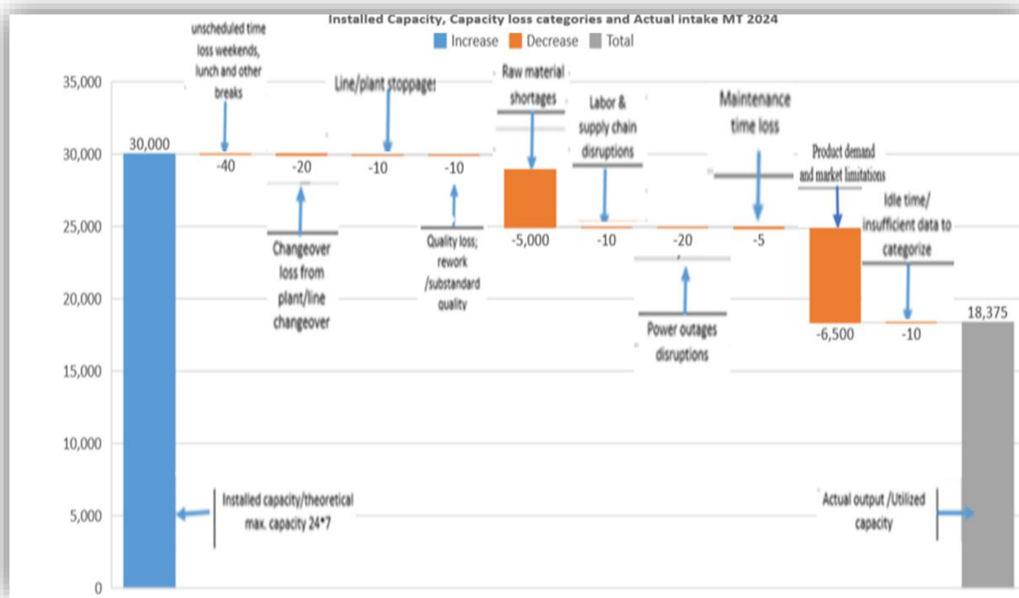



**Figure 16: Capacity utilisation and loss analysis 2024 – Maize Milling Case Study #002@ng – medium-scale**

*Overall equipment effectiveness analysis*

At *Maize Milling Case Study #002@ng – medium-scale*, quality losses were reported at 1% of productive time within 16 hours' net run time 6 days a week. From the data collected and analysed the OEE performance for Nestle Nigeria in the Year 2024 was reported as follows:

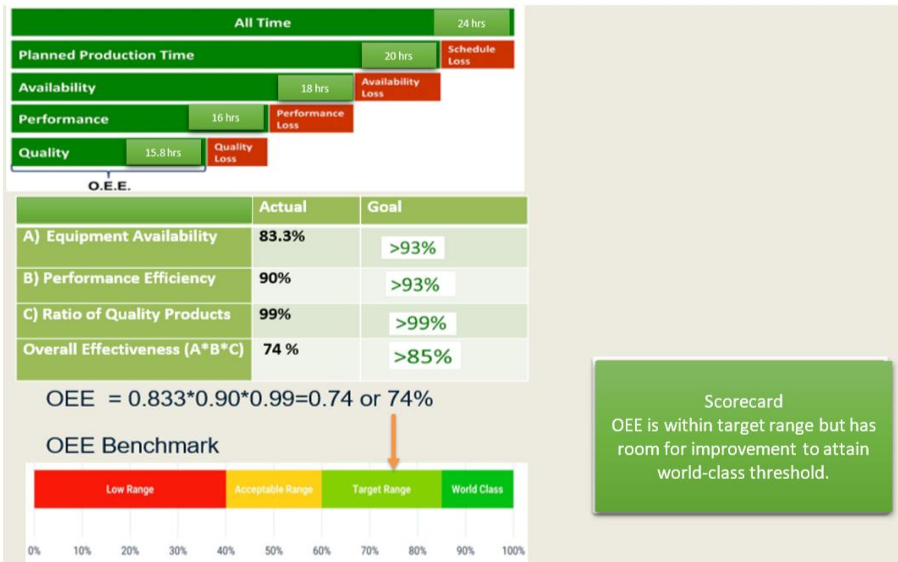



**Figure 17: Overall equipment effectiveness analysis 2024 – Maize Milling Case Study #002@ng – medium-scale**

*Conclusive case findings*

Capacity utilisation and Overall Equipment Effectiveness (OEE) are key metrics for assessing production efficiency. While OEE measures machine performance during scheduled production, including various losses, capacity utilisation indicates actual output on equipment use, considering both scheduled and unscheduled downtime. High capacity utilisation shows frequent machine operation, while OEE ensures that this operation is efficient. For *Maize Milling Case Study #002@ng – medium-scale*, a capacity utilisation rate of 52% was reported, while an OEE of 74% reveal an 11-point gap to reach the world-class OEE benchmark of 85%. This gap highlights the presence of 'hidden capacity' that can be optimised to boost the company's operational efficiency and output.

### 3.5.3 Conclusion: Maize milling in Nigeria

The survey findings indicate that Nigeria's maize milling industry is experiencing significant growth, fuelled by robust domestic demand, favourable government policies, and a large, urbanising population. While the country is a major maize producer, the gap between raw production and processed goods is widened by inadequate post-harvest infrastructure, leading to poor product quality, reduced shelf life, and significant losses. To improve, there is a need for investment in efficient milling equipment and technology, alongside support for agribusinesses to overcome factors like firm characteristics and inefficiencies that limit capacity utilisation. Most of Nigeria's maize is consumed domestically, especially by industries producing flour, beverages, and animal feed, highlighting the sector's strategic importance. Government initiatives like the Agricultural Promotion Policy and the African Continental Free Trade Agreement have created a supportive environment for expansion. Overall, the findings suggest that ongoing investment in technology and efficiency will be crucial for the industry's continued growth and its ability to support economic development and food security in Nigeria and the region.

## 3.6 Maize milling in Ghana

Maize milling in Ghana plays a crucial role in supplying flour and other maize products for local consumption. The industry employs both dry and wet milling methods to produce a range of products, including grits and flour. Facilities range from small operations to large-scale industrial plants, with modern mills utilising advanced technology. However, companies in this sector face challenges such as obtaining high-quality maize, market price fluctuations and financial constraints. Key players in Ghana's maize milling industry include Premium Foods Limited, a significant large-scale mill in Kumasi; Yedent Agro Food Processing, specialising in maize grit and fortified products in Sunyani; Omaf Farms and Flour Mill Co Ltd, focusing on corn flour in Accra; Philafrica Foods Ghana Limited, Nestle Ghana Ltd and Kedan Limited, based in Tumu, producing various maize-based products including grates and flour for animal feed.

### 3.6.1 Maize Milling Case Study #001@gh – large-scale

*Maize Milling Case Study #001@gh – large-scale* is an agribusiness and agro-processing firm based in the Upper West Region of Ghana, specialising in maize production and the processing of maize into flour and granular products. Established in 2011, the company actively supports smallholder farmers by supplying farm inputs and offering pre- and post-harvest services, in addition to operating a sizable maize farm in Tumu. With an installed capacity of 15,000 Mt, the company currently utilises 8,000 Mt annually. However, challenges such as high interest rates, competition from informal millers, and costly electricity hinder its capacity utilisation. The company's products are distributed equally between breweries and consumer product markets.

**Table 10: Annual throughput year 2023 & 2024 – Maize Milling Case Study #001@gh – large-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (MT/month) | Actual intake(MT/months) | Utilization rate (%) | Month | Installed/Design capacity (MT/month) | Actual intake(MT/Month | Utilization rate (%) |
| Jan | 1,250 | 600 | 48.00 | Jan | 1,250 | 485 | 38.80 |
| Feb | 1,250 | 550 | 44.00 | Feb | 1,250 | 595 | 47.60 |
| March | 1,250 | 480 | 38.40 | March | 1,250 | 650 | 52.00 |
| April | 1,250 | 485 | 38.80 | April | 1,250 | 780 | 62.40 |
| May | 1,250 | 500 | 40.00 | May | 1,250 | 800 | 64.00 |
| June | 1,250 | 580 | 46.40 | June | 1,250 | 485 | 38.80 |
| July | 1,250 | 450 | 36.00 | July | 1,250 | 750 | 60.00 |
| August | 1,250 | 400 | 32.00 | August | 1,250 | 780 | 62.40 |
| September | 1,250 | 960 | 76.80 | September | 1,250 | 450 | 36.00 |
| October | 1,250 | 900 | 72.00 | October | 1,250 | 675 | 54.00 |
| November | 1,250 | 850 | 68.00 | November | 1,250 | 960 | 76.80 |
| December | 1,250 | 750 | 60.00 | December | 1,250 | 990 | 79.20 |
| Total | 15,000 | 7,505 | 50.03 | Total | 15,000 | 7,950 | 53.00 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =50%

Year 2024 =53%

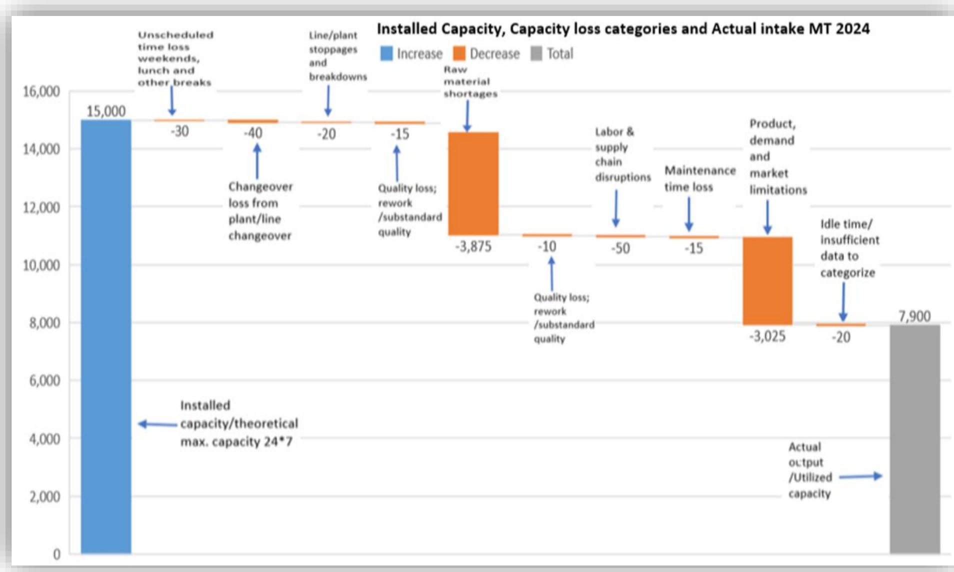



**Figure 18: Capacity utilisation and loss analysis 2024 – Maize Milling Case Study #001@gh – large-scale**

*Overall equipment effectiveness analysis*

At *Case Study #001@gh – large-scale*, quality losses were reported at 5% of productive time within 16 hours' net run time 6 days a week. From the data collected and analysed the OEE performance for the company in the Year 2024 was reported as follows:

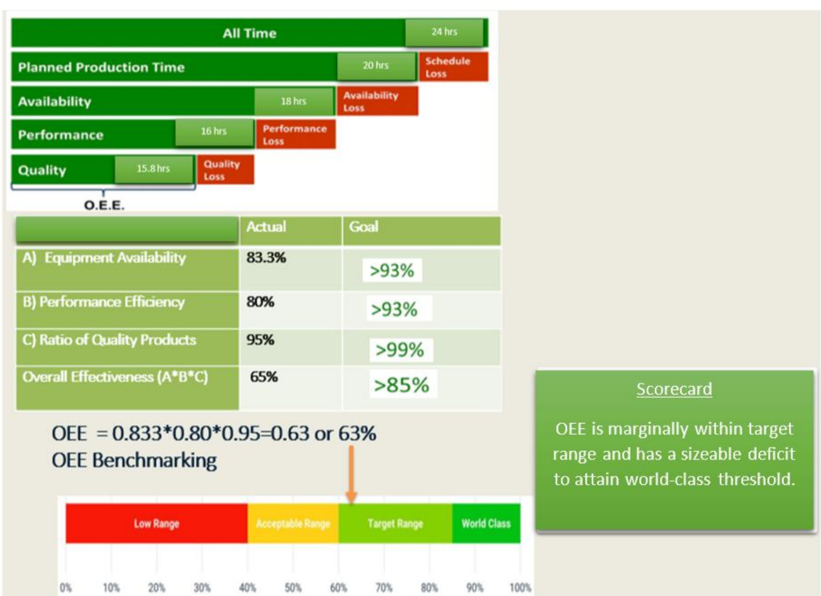



**Figure 19: Overall equipment effectiveness analysis 2024 – Maize Milling Case Study #001@gh – large-scale**

*Conclusive case findings*

Capacity utilisation measures the efficiency of the production process, considering both productive and non-productive time. Conversely, Overall Equipment Effectiveness (OEE) measures how well machinery performs during scheduled production, including downtime. While OEE helps identify and reduce the "six big losses" that limit capacity utilisation, capacity utilisation offers a broader perspective on how resources are used in production. For Maize Milling Case Study #001@gh –Large-scale, a capacity utilisation rate of 53% was reported while an OEE of 63% points to a 22-point gap to reach a world-class OEE benchmark of 85%. This reveals 'hidden capacity' and opportunities for operational improvements. The company's main challenge is largely a shortage of raw materials.

### 3.6.2 Maize Milling Case Study #002@gh – medium-scale

*Maize milling Case Study #002@gh*, is a food and beverage company and, has been serving Ghana consumers with high-quality nutritious products for years. With a workforce of more than 1,500 employees and operating out of Temu manufacturing site, the company produces well-known baby food brands. Its maize milling division has an annual capacity of 2,000 metric tons but currently averages a throughput of 800-1200 metric tons. The company confronts significant challenges related to the quality and availability of grain maize due to stringent quality parameters. Despite these difficulties, a strong network of dedicated suppliers supports contracted farmers, and there is substantial demand for the products, indicating potential for increased capacity utilisation.

**Table 11: Annual throughput year 2023 & 2024 – Maize Milling Case Study #002@ng – medium-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (MT/month) | Actual intake(MT /months) | Utilization rate (%) | Month | Installed/Design capacity (MT/month) | Actual intake(MT/Mo nth | Utilization rate (%) |
| Jan | 180 | 80 | 44.44 | Jan | 180 | 100 | 55.56 |
| Feb | 180 | 100 | 55.56 | Feb | 180 | 100 | 55.56 |
| March | 180 | 90 | 50.00 | March | 180 | 100 | 55.56 |
| April | 180 | 80 | 44.44 | April | 180 | 100 | 55.56 |
| May | 180 | 100 | 55.56 | May | 180 | 100 | 55.56 |
| June | 180 | 80 | 44.44 | June | 180 | 100 | 55.56 |
| July | 180 | 100 | 55.56 | July | 180 | 90 | 50.00 |
| August | 180 | 90 | 50.00 | August | 180 | 100 | 55.56 |
| September | 180 | 80 | 44.44 | September | 180 | 100 | 55.56 |
| October | 180 | 100 | 55.56 | October | 180 | 100 | 55.56 |
| November | 180 | 100 | 55.56 | November | 180 | 100 | 55.56 |
| December | 180 | 100 | 55.56 | December | 180 | 100 | 55.56 |
| Total | 2,160 | 1,100 | 50.93 | Total | 2,160 | 1,090 | 50.46 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =51%

Year 2024 =50%

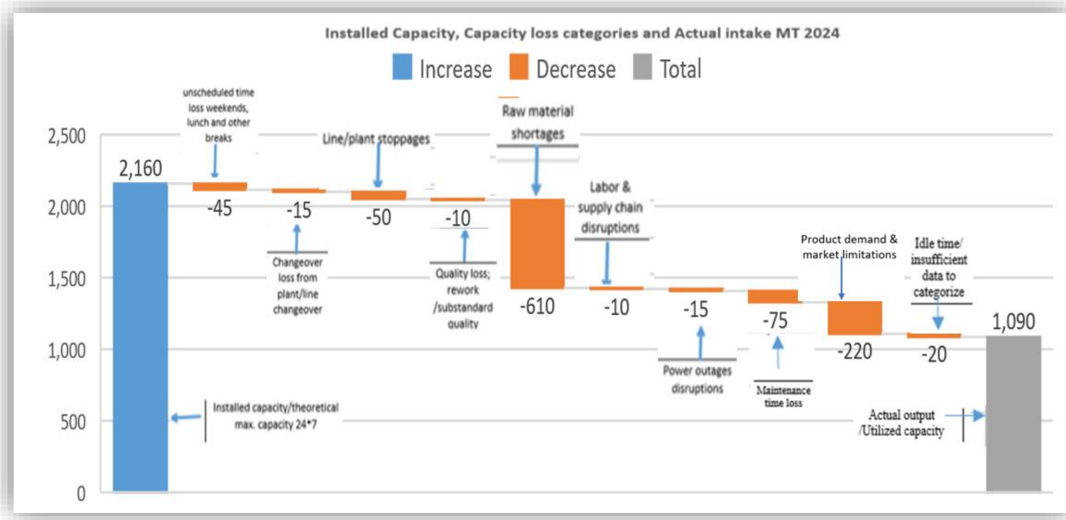



**Figure 20: Capacity utilisation and loss analysis 2024 – Maize Milling Case Study #002@gh –medium-scale**

*Overall equipment effectiveness*

At *Maize Milling Case Study #002@ng – medium-scale,* quality losses were reported at 4% of productive time over 10 hours of runtime, 6 days a week. From the data collected and analysed, the OEE performance for the company in the Year 2024 was reported as follows:

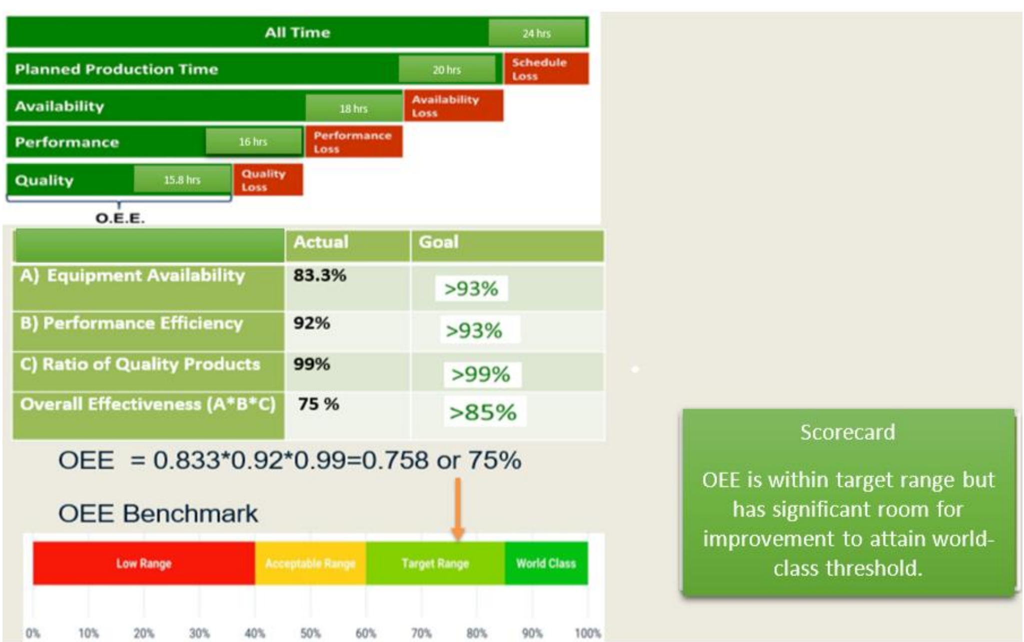



**Figure 21: Overall equipment effectiveness analysis 2024 – Maize Milling Case Study #002@ng – medium-scale**

*Conclusive case findings*

Capacity utilisation is a critical measure of production efficiency, incorporating both productive and non-productive time. OEE (Overall Equipment Effectiveness) focuses on equipment performance during scheduled production, capacity utilisation encompasses the full potential of the equipment, factoring in both types of downtime. OEE identifies and mitigates significant loss factors such as breakdowns, setup times, idling, reduced speeds, defects, and rejects, which directly affect capacity utilisation. In this context, *Case Study #002@ng – medium-scale*, capacity utilisation for 2024 stood at 50%, with an OEE of 75%, suggesting a gap of 10 points to reach the world-class standard of 85%. This discrepancy indicates the presence of 'hidden capacity' that could be optimised without investment in new machinery, particularly in light of current resource and operational limitations. The underperformance is primarily linked to insufficient quality raw materials.

## 3.7 Conclusions: Maize milling in Ghana

Maize milling in Ghana presents notable business prospects and supports employment, but the industry is hampered by maize grain shortage and quality control challenges. The milling sector, particularly industrial processing, is under-developed and does not utilise its full potential due to a lack of modern equipment and insufficient commercial processing. Rain-dependent farming, inadequate storage leading to aflatoxin contamination, and inconsistent input quality remain significant obstacles. Optimising milling and preprocessing methods, along with adopting proper storage technologies, is crucial for industry's optimal performance. Successfully addressing these issues will strengthen the economic sustainability of maize milling in Ghana and deliver widespread benefits to consumers, millers, and the agricultural sector.

## 3.8 Comparative maize milling capacity utilisation

The survey examined 8 milling businesses (4 large and 4 medium-scale) across Kenya, Nigeria, Ghana, and Malawi, revealing significant differences driven by market structure, consumer preferences, and economic factors. Kenya and Nigeria maize milling industries are the most concentrated and vertically integrated, dominated by large millers, while Malawi and Ghana rely more on small to medium-scale millers comparatively. In all cases maize millers are influenced by both local production and imports. Kenya has the highest formal sector utilisation, with urban demand for sifted meal and high preferences for white meal. Ghana and Malawi faces high maize prices due to currency issues, while Nigeria has the lowest maize prices. Overall, firms operate at low capacity – maximum 62% for large-scale and 52% for medium-scale maize mills. Only about a third of firms operate year-round, with many limited by raw material shortages and unreliable electricity. Firms with alternative power and better storage run more consistently. Technology choices further affect product quality and efficiency across the surveyed countries. Key challenges identified include raw material shortages, limited market access, and unreliable input supplies, which contribute to underutilisation of installed milling capacity.

**Table 12: Summary of processing capacity and capacity utilisation of surveyed maize millers**

| Commodity | Agro-processing firm | Country | Scale | Average installed processing capacity (MT annually) | Actual capacity utilisation (MT)/year | Percentage of capacity utilisation (%) 2024 |
|---|---|---|---|---|---|---|
| **Maize milling** | Case study #001@ke | Kenya | Large | 225,000 | 168,630 | 75% |
| | Case study #002@ke | Kenya | Medium | 18,000 | 8,302 | 46% |
| | Case study #001@mw | Malawi | Large | 120,000 | 82,460 | 69% |
| | Case study #002@mw | Malawi | Medium | 1200 | 725 | 60% |
| | Case study #001@ng | Nigeria | Large | 300,000 | 156,000 | 52% |
| | Case study #002@ng | Nigeria | Medium | 30,000 | 15,600 | 52% |
| | Case study #002@gh | Ghana | Large | 15,000 | 7,950 | 53% |
| | Case study #002@gn | Ghana | Medium | 2160 | 1,090 | 50% |

Capacity underutilisation disparities among large and medium-scale maize milling, as revealed by the survey, shows that medium-scale operators have much lower reported utilisation capacity across the countries attributable to multiple factors, chief of which is shortage and inconsistent supply of raw maize occasioned by limited access to finance and technology, and market-related challenges. Overall, seasonal variability, price volatility and government interference collectively hinder optimal capacity utilisation in maize milling operations in the four countries surveyed.

## 3.9 Benchmarking and disparities in maize milling

The survey findings on maize milling in Kenya, Nigeria, Malawi, and Ghana reveal that large-scale millers operate at above average capacity while medium-tier mills are operating borderline average optimal capacity. The aggregate capacity utilisation from the four countries range from about 62% for large millers and 52% for medium tier millers. While these mills are more efficient than small-scale operations, they face challenges such as reliance on government-rationed maize, post-harvest losses, and inconsistent harvest yields. The size and spectrum of mills varies across countries, with Kenya, Malawi and Nigeria with comparable large-scale peers while Ghana has much smaller large and medium-scale millers. Access to technology, infrastructure, and government policies has a significant impact on production and market access throughout the region. The findings also highlight opportunities for benchmarking efficiency, technology adoption, product diversification, and sharing best practices across the value chain to boost productivity and competitiveness.

Key areas for benchmarking include:

1. **Production efficiency**: There is need to evaluating and establish maize flour yields, input utilisation, and labour productivity across regions to identify industry benchmarks and improvement opportunities.
2. **Milling efficiency:** There is need to investigate throughput, energy consumption, and waste in milling operations to ascertain industry benchmarks to inform process optimisation and cost reduction.
3. **Product diversification:** Benchmarking against fortified flour, animal feed, or maize snacks can uncover diversification prospects and enhance profitability.
4. **Supply chain management:** there is need conduct further analysis on sourcing, storage, transport, and distribution practices to minimise losses and enhance the efficiency of the maize value chain.
5. **Sustainability practices:** Benchmarking environmental impact and social responsibility to foster sustainable maize production and processing practices is critical and should embraced.

By conducting comprehensive benchmarking practices, the African maize milling sector can identify areas for improvement, enhance efficiency, and play a significant role in improving food processing and promoting economic development across the continent.

# 4.0 Findings on beef meat processing

The report findings reveal that beef processing sectors in Kenya, Nigeria and Malawi faces significant challenges despite following standard methods such as slaughtering, chilling, and cutting. Major issues include inadequate infrastructure – especially a lack of modern slaughterhouses and cold chains – which results in inconsistent product quality. The sector is further constrained by a large informal market, health and safety risks, low productivity, and inconsistent supply and quality of beef livestock. Capacity utilisation across processing plants varies widely. While some facilities operate efficiently, many struggle due to competition from informal markets, infrastructure deficits, fluctuating cattle supply, inconsistent demand, and disease outbreaks. Additional barriers include limited investment, outdated technology, and inefficiencies in staffing, training, and logistics. Targeted investments in modern facilities, adoption of new technologies, better transportation and storage, a focus on quality and traceability, and increased government support is essential. These improvements are essential for enhancing efficiency, meeting consumer demand, and boosting competitiveness against imports.

## 4.1 Factors influencing beef meat processing capacity utilisation

The survey results show that beef processing capacity use in the countries studied is limited by several factors. Major challenges include inconsistent livestock supply resulting from poor genetics, animal diseases, and inadequate feed. Other issues are inadequate infrastructure, weak policies and enforcement, limited access to credit and technical support, and inefficiencies in marketing and industry integration.

1. **Supply-side factors**
    - **Livestock genetics:** Using traditional, lower-yielding breeds instead of more productive exotic breeds restricts the number of animals available for processing.
    - **Animal health and diseases:** The presence of diseases leads to higher mortality, sickness, and increased management costs, which directly cut down the supply of cattle.
    - **Feed and land access:** Limited grazing land and a lack of affordable, quality feed raise production costs and reduce productivity.
    - **Farmer and market access:** Many traditional cattle systems are not well-connected to formal markets, resulting in low and inconsistent sales volumes for processors.
2. **Infrastructure and logistics**
    - **Transportation:** Poor road networks and infrastructure increase transport costs and reduce the efficiency of moving inputs and finished products.
    - **Energy:** Unreliable energy supplies hinder modern processing, especially for keeping cold chains and other technologies operational.
    - **Processing facilities:** Many slaughterhouses lack proper infrastructure for hygienic processing, storage, and waste disposal, leading to poor practices and limited throughput.
3. **Policy, finance, and management**
    - **Enabling environment:** Weak policies, poor enforcement, and regulations that do not support the industry can discourage investment and modernisation.
    - **Financial constraints:** Limited access to credit for farmers and processors blocks investments in better technology and infrastructure.

- **Technical support**: Lack of technical knowledge, training, and extension services affects the quality and consistency of beef supply.

4. **Market and demand side**
    - **Inconsistent demand:** The need for processed beef can vary due to socio-cultural factors or price fluctuations, affecting processing demand.
    - **Competition:** Competition for resources like grains, used both for human food and animal feed, can drive up costs and disrupt the supply chain.

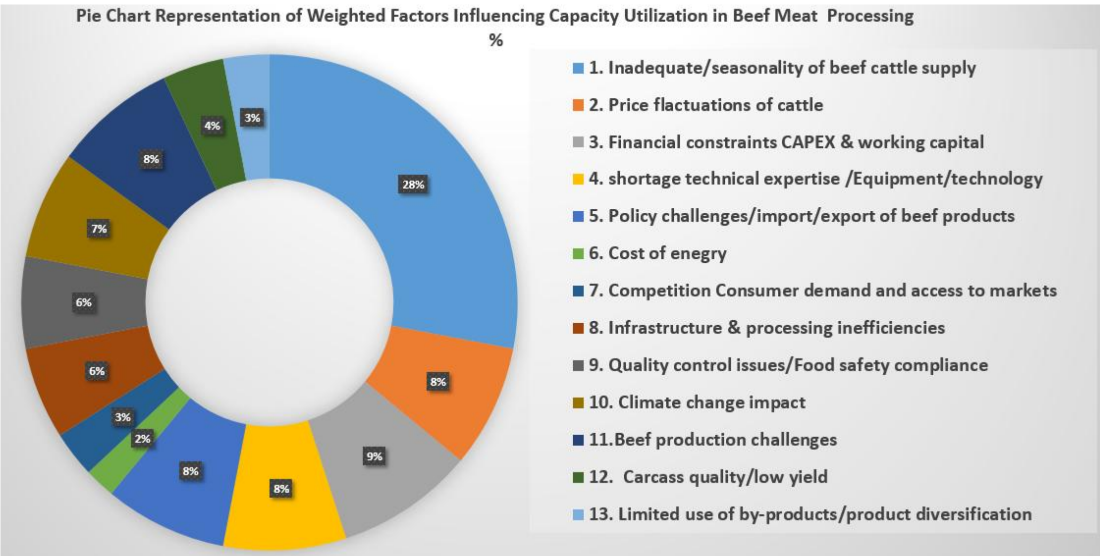



**Figure 22: Weighted factors influencing beef meat processing capacity utilisation**

## 4.2 Beef meat processing in Kenya


The demand for beef products in Kenya surpasses supply, resulting in an annual deficit of 250,000 metric tons. This shortfall is driven by factors such as population growth, urbanisation, and rising incomes, which the meat industry has struggled to keep pace with. As Kenya approaches middle-income status, beef demand is expected to increase, with production projected to reach 480,000 metric tons by 2026, while consumption is expected to reach 626,000 metric tons. Many beef meat processing facilities currently operate at below-capacity levels due to market fluctuations and supply chain issues. The industry must adhere to stringent safety regulations to access export markets and become competitive. Beef production faces numerous challenges, including cattle nutrition, breeding, infrastructure, disease management, and the impact of climate change. Key players in the Kenyan beef value chain include Quality Meat Packers (QMP), Kenya Meat Commission (KMC), KenMeat, Choice Meats, Shun Lida Foods EPZ Ltd, Morendat Farm, and several public and private abattoirs across the country, all contributing significantly to various aspects of meat processing and distribution.

### Features of Kenya's beef industry

- **Dominance of the informal meat sector:** The informal meat sector in Kenya constitutes approximately 64% of the market, encompassing public and private abattoirs, slaughter slabs, butcheries, and local vendors, despite a rise in formal meat processors and specialty shops.
- **Livestock procurement and sourcing:** Rigorous livestock procurement protocols are enforced, including veterinary inspections to ensure quality and safety.
- **Slaughtering and processing:** Slaughtering and processing facilities maintain designated areas for clean and dirty operations, producing various beef cuts and value-added products such as meatballs and burgers.
- **Chilling and aging:** Some facilities offer carcass chilling at temperatures of 0-2°C for durations of 5-21 days to enhance meat tenderness through the aging process.
- **Varied utilisation:** Many large and medium-sized processors operate below capacity, with some functioning at only 50-60%.
- **Market fluctuations:** The industry faces processing volume fluctuations caused by seasonal livestock availability and market demand.
- **Concentration of processing:** Due to the capital and labour intensity of meat processing, facilities tend to cluster in urban regions, making competition challenging for others.
- **Service kill agreements:** Supermarkets are increasingly adopting service kill agreements, paying processors to process livestock, which limits processors' control over livestock pricing.
- **Feedlots and grain-fed beef:** The Kenyan feedlot sector is expanding, marked by notable increases in grain-fed beef production and exports, driven by global demand.
- **Industry growth:** The Kenyan meat processing industry has experienced growth, achieving record levels of beef production and slaughter in recent years.

### 4.2.1 Beef Meat Processing Case Study #001@ke – large-scale

*Beef Meat Processing Case Study #001@ke – large-scale* is the beef division of a composite meat processing Group and operates a modern certified slaughterhouse and butchery in Nairobi. The facility adheres to ISO 22000:2005 standards for Food Safety Management Systems and is licensed for exports by the Director of Veterinary Services. Additionally, it holds Halal certification from both the Supreme Council of Kenya Muslims (SUPKEM) and the Kenya Bureau of Halal Certification (KBHC).

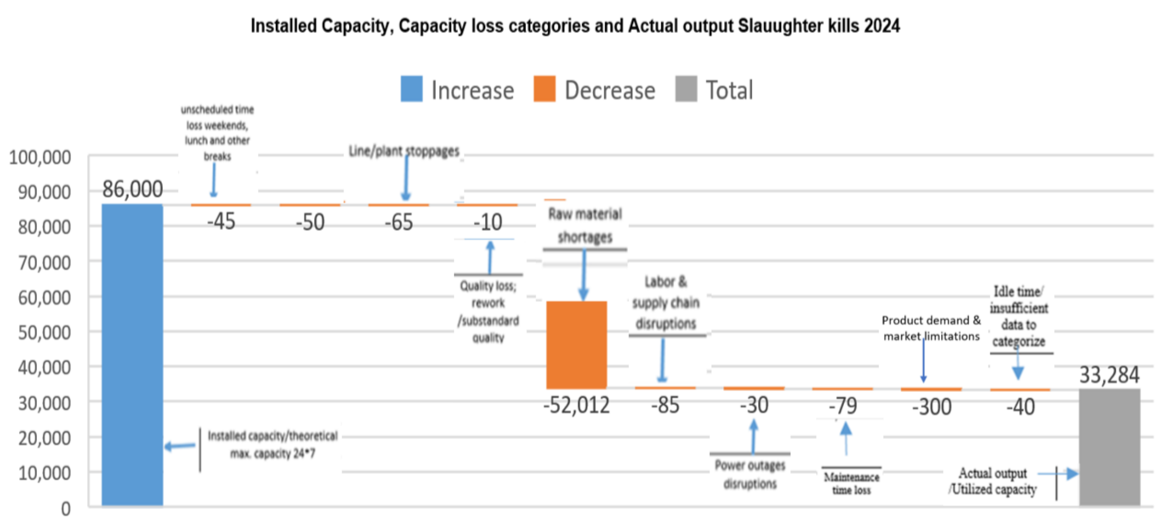
**Table 13: Annual throughput year 2023 & 2024 – Beef Meat Processing Case Study #001@ke – large-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (carcsses/month) | Output (carcasses per months) | Utilization rate (%) | Month | Installed/Design capacity (carcsses/month) | Output (carcasses per months) | Utilization rate (%) |
| Jan | 7,200 | 2,170 | 30 | Jan | 7,200 | 2,750 | 38 |
| Feb | 7,200 | 2,470 | 34 | Feb | 7,200 | 2,850 | 40 |
| March | 7,200 | 2,300 | 32 | March | 7,200 | 2,825 | 39 |
| April | 7,200 | 2,770 | 38 | April | 7,200 | 3,255 | 45 |
| May | 7,200 | 2,250 | 31 | May | 7,200 | 2,950 | 41 |
| June | 7,200 | 2,270 | 32 | June | 7,200 | 2,759 | 38 |
| July | 7,200 | 2,448 | 34 | July | 7,200 | 2,956 | 41 |
| August | 7,200 | 2,980 | 41 | August | 7,200 | 3,254 | 45 |
| September | 7,200 | 2,370 | 33 | September | 7,200 | 2,979 | 41 |
| October | 7,200 | 2,760 | 38 | October | 7,200 | 3,024 | 42 |
| November | 7,200 | 2,970 | 41 | November | 7,200 | 3,257 | 45 |
| December | 7,200 | 3,080 | 43 | December | 7,200 | 3,404 | 47 |
| Total | 86,400 | 30,838 | 36 | Total | 86,400 | 33,284 | 39 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =35.69%

Year 2024 =38.52%




Installed Capacity, Capacity loss categories and Actual output slaughter kills 2024

**Figure 23: Capacity utilisation and loss analysis 2024 – Beef Meat Processing Case Study #001@ke – large-scale**

*Overall equipment effectiveness analysis*

At *Beef Meat Processing Case Study #001@ke – large-scale*, quality losses were reported at 4% of productive time over 10 hours of runtime, 6 days a week. From the data collected and analysed, the OEE performance for the company in the Year 2024 was reported as follows:

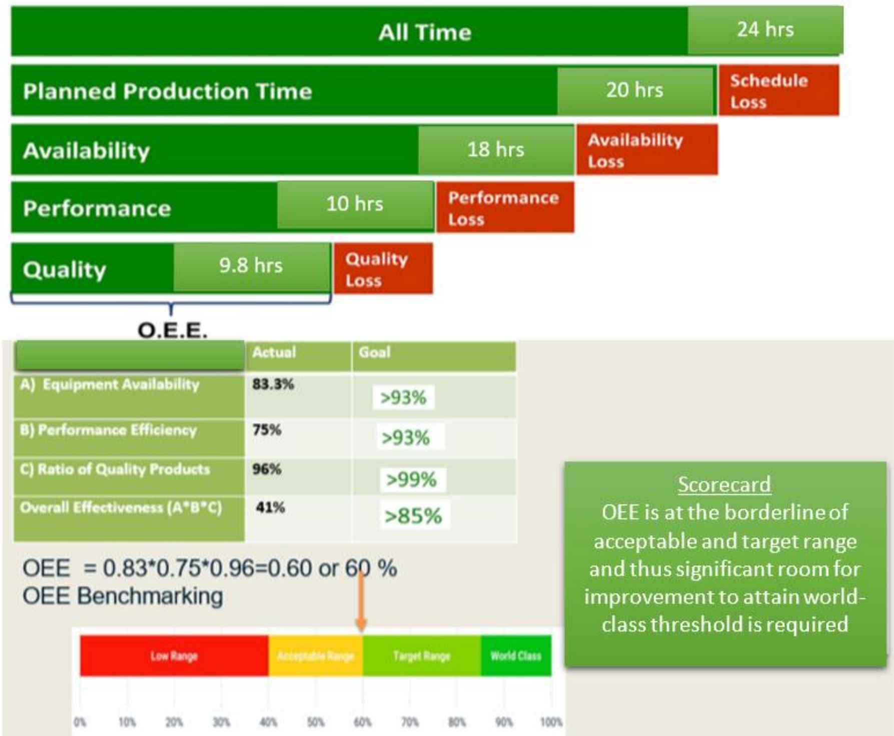



**Figure 24: Overall equipment effectiveness analysis 2024 – Beef Meat Processing Case Study #001@ke – large-scale**

*Conclusive case findings*

Capacity utilisation measures the effectiveness of the production process by considering both productive and non-productive time. Meanwhile, Overall Equipment Effectiveness (OEE) assesses how well equipment performs during scheduled production periods. OEE highlights significant losses impacting capacity utilisation and helps identify opportunities to improve equipment efficiency. A high capacity utilisation rate indicates frequent machine operation; however, OEE evaluates its effectiveness. For *Beef Meat Processing Case Study #001@ke – large-scale*, the reported capacity utilisation for 2024 was 39%, and the OEE was 60%. This reveals a 25-point gap to reach a world-class OEE of 85%, showing significant potential to optimise existing equipment and resources without investing in new machinery. By analysing both metrics, the company can improve operational efficiency and output.

### 4.2.2 Beef Meat Processing Case Study 002@ke – medium-scale

*Beef Meat Processing Case Study 002@ke – medium-scale* is premium, aged beef farm in Naivasha, Kenya, renowned for its high-quality meat products, which are sold in high-end hotels. The company owns the farm and focuses on independent production, raising its animals on homegrown feeds to ensure quality and disease control. The company operates an integrated farm-to-table approach comprising own ranch, and an integrated abattoir.

**Table 14: Annual throughput year 2023 & 2024 – Beef Meat Processing Case Study #002@ke – medium-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (animal carcass/month) | Output (animal carcases /months) | Utilization rate (%) | Month | Installed/Design capacity (animal carcass/month) | Output (animal carcases /months) | Utilization rate (%) |
| Jan | 120 | 45 | 38 | Jan | 120 | 44 | 66 |
| Feb | 120 | 40 | 33 | Feb | 120 | 45 | 53 |
| March | 120 | 58 | 48 | March | 120 | 42 | 65 |
| April | 120 | 48 | 40 | April | 120 | 50 | 73 |
| May | 120 | 56 | 47 | May | 120 | 48 | 68 |
| June | 120 | 67 | 56 | June | 120 | 42 | 57 |
| July | 120 | 56 | 47 | July | 120 | 44 | 66 |
| August | 120 | 33 | 28 | August | 120 | 51 | 58 |
| September | 120 | 46 | 38 | September | 120 | 57 | 55 |
| October | 120 | 57 | 48 | October | 120 | 42 | 66 |
| November | 120 | 66 | 55 | November | 120 | 48 | 70 |
| December | 120 | 75 | 70 | December | 120 | 66 | 78 |
| Total | 1,440 | 647 | 45 | Total | 1,440 | 522 | 36 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =41%

Year 2024 =36%

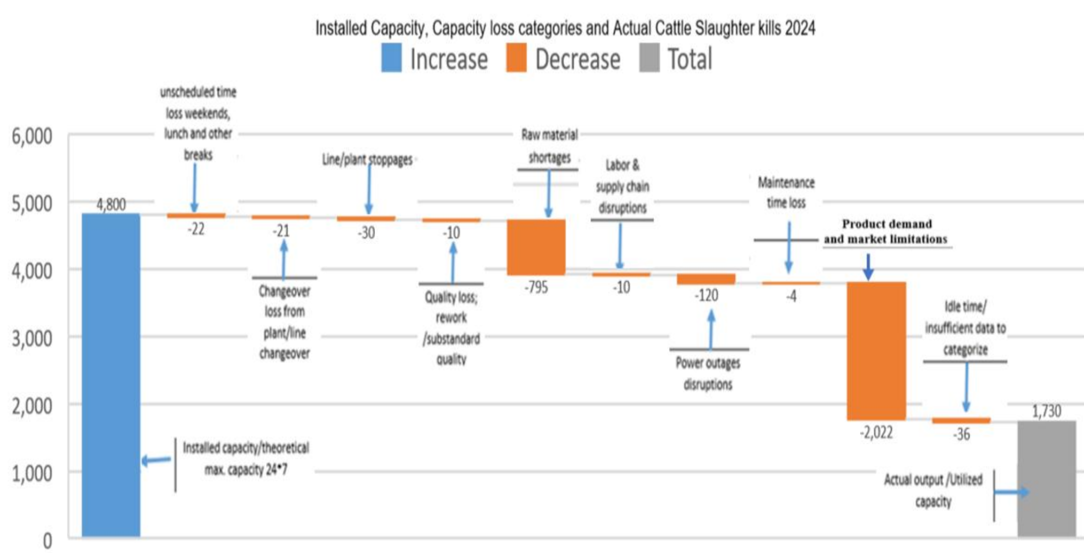



**Figure 25: Capacity utilisation and loss analysis 2024 – Beef Meat Processing Case Study #002@ke – medium-scale**

*Overall equipment effectiveness analysis*

At *Beef Meat Processing Case Study 002@ke – medium-scale*, quality losses were reported at 4% of productive time over 8 hrs of runtime, 5 days a week. From the data collected and analysed, the OEE performance for Morendat Farm in the Year 2024 was reported as follows:


**Figure 26: Overall equipment effectiveness analysis 2024 – Beef Meat Processing Case Study #002@ke – medium-scale**

*Conclusive case findings*

Capacity utilisation is a vital measure of production efficiency that accounts for both productive and non-productive time. Unlike Overall Equipment Effectiveness (OEE), which evaluates equipment efficiency during scheduled production, capacity utilisation measures the equipment's total potential, including both scheduled and unscheduled downtime. OEE helps identify the "six significant losses' that impact capacity utilisation, making it a valuable tool for improving equipment performance. While high capacity utilisation indicates frequent machine operation, OEE measures the effectiveness of that operation. For *Beef Meat Processing Case 002@ke – medium-scale*, the 2024 capacity utilisation rate was 36%, with an OEE of 56%. This gap highlights a significant opportunity to improve OEE; achieving a world-class 85% could yield a 29-point increment, revealing considerable hidden capacity within their current operations and resources.

### 4.2.3 Conclusions: Beef processing in Kenya

The survey findings on Kenya's beef processing sector underscore the need to enhance beef lot and fattening models, upgrade infrastructure, improve disease control, and expand value-added processing to strengthen market access and profitability. Significant challenges include the adverse effects of drought on cattle supply and carcass quality, as well as gaps in the cold chain system and a shortage of skilled labour. Both Medium and large processors are operating at below average capacity. The report also emphasises the importance of product diversification, the use of by-products, and the creation of affordable products for low-income consumers to boost capacity utilisation. Strengthening food safety standards, encouraging collaboration across the value chain, and focusing on sustainability – including better environmental practices and data management – are essential for the sector's long-term growth and competitiveness.

## 4.3 Beef meat processing in Malawi

The beef processing industry in Malawi is experiencing steady growth, driven by increasing domestic demand and the pursuit of export opportunities. Smallholder farmers, who supply most of the beef, are at the heart of the sector but face ongoing challenges, including inbreeding, limited veterinary services, disease management, and inefficient markets, all of which limit productivity. Despite these hurdles, the sector is evolving through government initiatives to upgrade production systems, improve genetic quality, and encourage the shift from smallholder to commercial operations. Leading companies such as Nyama World, ORI Meat Products, Ekhaya Farms, Go Fresh Limited, and TCG are investing in integrated value chains and modern processing facilities, including new abattoirs that meet international standards. Although per capita beef consumption in Malawi remains below regional and global averages, projections indicate significant growth in both consumption and production over the next decade. The industry's expansion is further supported by efforts to add value through cattle fattening and processing, but financial limitations, infrastructure needs, and economic instability continue to create critical challenges. Overall, Malawi's beef sector shows strong potential for growth and export opportunities, provided that current constraints are addressed through ongoing investment and innovation.

### 4.3.1 Beef Meat Processing Case Study 001@mw – large-scale

*Beef Meat Processing Case Study 001@mw – large-scale* is a leading meat processing company based in Lilongwe, Malawi, known as one of the country's biggest beef processors. The company runs a wholesale and retail outlet in Kanengo. It has a modern Halal-certified abattoir combined with refrigerated transport trucks. However, its production has decreased from 14,689 slaughter kills in 2023 to 11,696 in 2024, due to a mix of adverse weather, cattle financing problems, foreign exchange issues, cross-border trade disruptions, and hyperinflation. Currently, the company operates on a single eight-hour shift, six days a week, with a dressing percentage of 48-50%, mainly because of lower animal quality. The facility features eight cold rooms capable of chilling 10 tons of beef products. The company is actively preparing for ISO certification.

**Table 15: Annual throughput year 2023 & 2024 – Beef Meat Processing Case Study #001@mw – large-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (animal carcass/month) | Output (animal carcases /months) | Utilization rate (%) | Month | Installed/Design capacity (animal carcass/month) | Output (animal carcases /months) | Utilization rate (%) |
| Jan | 2,500 | 1,210 | 48 | Jan | 2,500 | 1,055 | 42 |
| Feb | 2,500 | 1,100 | 44 | Feb | 2,500 | 966 | 39 |
| March | 2,500 | 1,200 | 48 | March | 2,500 | 1,140 | 46 |
| April | 2,500 | 1,320 | 53 | April | 2,500 | 1,200 | 48 |
| May | 2,500 | 1,250 | 50 | May | 2,500 | 1,100 | 44 |
| June | 2,500 | 1,133 | 45 | June | 2,500 | 850 | 34 |
| July | 2,500 | 998 | 40 | July | 2,500 | 910 | 36 |
| August | 2,500 | 1,286 | 51 | August | 2,500 | 1,010 | 40 |
| September | 2,500 | 1,214 | 49 | September | 2,500 | 990 | 40 |
| October | 2,500 | 1,268 | 51 | October | 2,500 | 1,055 | 42 |
| November | 2,500 | 1,344 | 54 | November | 2,500 | 1,110 | 44 |
| December | 2,500 | 1,486 | 59 | December | 2,500 | 1,300 | 52 |
| Total | 30,000 | 14,809 | 49 | Total | 30,000 | 11,696 | 39 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =49%

Year 2024 =39%

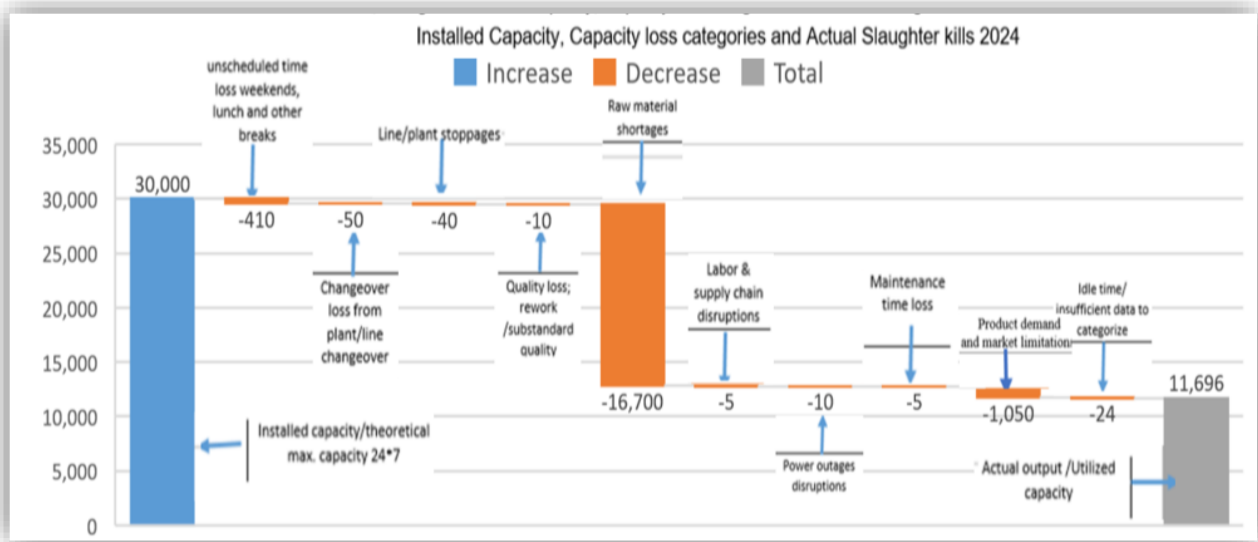



**Figure 27: Capacity utilisation and loss analysis 2024 – Beef Meat Processing Case Study #001@mw – large-scale**

*Overall equipment effectiveness analysis*

At *Beef Meat Processing Case 001@mw - large-scale*, quality losses were reported at 4% of productive time over 8 hours of run time, 5 days a week. From the data collected and analysed, the OEE performance for the company in the Year 2024 was reported as follows:

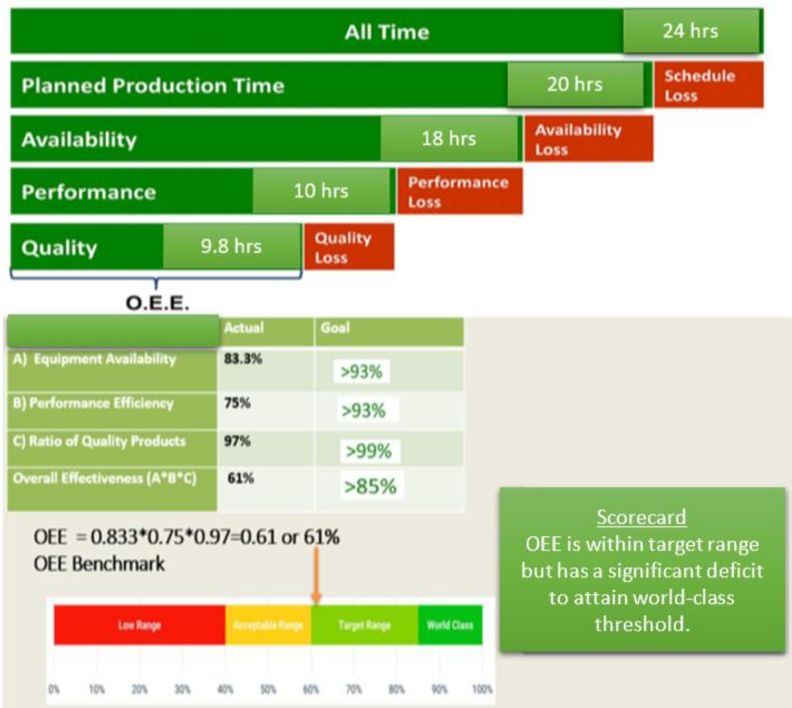



**Figure 28: Overall equipment effectiveness analysis 2024 – Beef Meat Processing Case Study #001@mw – large-scale**

*Conclusive case findings*

Capacity utilisation measures how effectively the production process uses time, including both productive and non-productive periods. At the same time, Overall Equipment Effectiveness (OEE) evaluates how well equipment performs during scheduled production times. OEE identifies significant losses that impact capacity utilisation, helping target areas for improvement in equipment efficiency. A high capacity utilisation rate shows machines are running frequently, but OEE assesses how effectively they operate. For the *Beef Meat Processing Case 001@mw - large-scale*, the 2024 capacity utilisation rate was 39% and the OEE was 61%. This reveals a 24-point gap from a world-class OEE of 85%, indicating significant potential to exploit existing equipment and resources without investing in new machinery. By focusing on both metrics, the company can boost operational efficiency and output.

### 4.3.2 Beef Meat Processing Case Study 002@mw – medium-scale

Beef meat processing case study 002@mw – medium-scale is a meat processing company in Lilongwe that operates a butchery and a meat processing plant. It sells meat products – such as chicken, fish, goat, and lamb – as well as fruits and vegetables. The company also runs a feedlot with approximately 300 animals and sources an additional 30-50 animals from out-growers each month. It does not own its own abattoir and depends on outsourcing. Key challenges include feed availability, high business costs, forex shortages, equipment needs, and veterinary services. The company plans to expand capacity by enlarging the bull fattening lot, improving breeding stock, and opening more outlets.

**Table 16: Annual throughput year 2023 & 2024 – Beef Meat Processing Case Study #002@mw – medium-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (animal carcass/month) | Output (animal carcases /months) | Utilization rate (%) | Month | Installed/Design capacity (animal carcass/month) | Output (animal carcases /months) | Utilization rate (%) |
| Jan | 100 | 35 | 35 | Jan | 100 | 40 | 40 |
| Feb | 100 | 40 | 40 | Feb | 100 | 45 | 45 |
| March | 100 | 36 | 36 | March | 100 | 48 | 48 |
| April | 100 | 45 | 45 | April | 100 | 50 | 50 |
| May | 100 | 48 | 48 | May | 100 | 48 | 48 |
| June | 100 | 44 | 44 | June | 100 | 42 | 42 |
| July | 100 | 48 | 48 | July | 100 | 44 | 44 |
| August | 100 | 45 | 45 | August | 100 | 51 | 51 |
| September | 100 | 46 | 46 | September | 100 | 38 | 38 |
| October | 100 | 47 | 47 | October | 100 | 42 | 42 |
| November | 100 | 48 | 48 | November | 100 | 48 | 48 |
| December | 100 | 55 | 55 | December | 100 | 53 | 53 |
| Total | 1,200 | 537 | 45 | Total | 1,200 | 511 | 43 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =45%

Year 2024 =43%

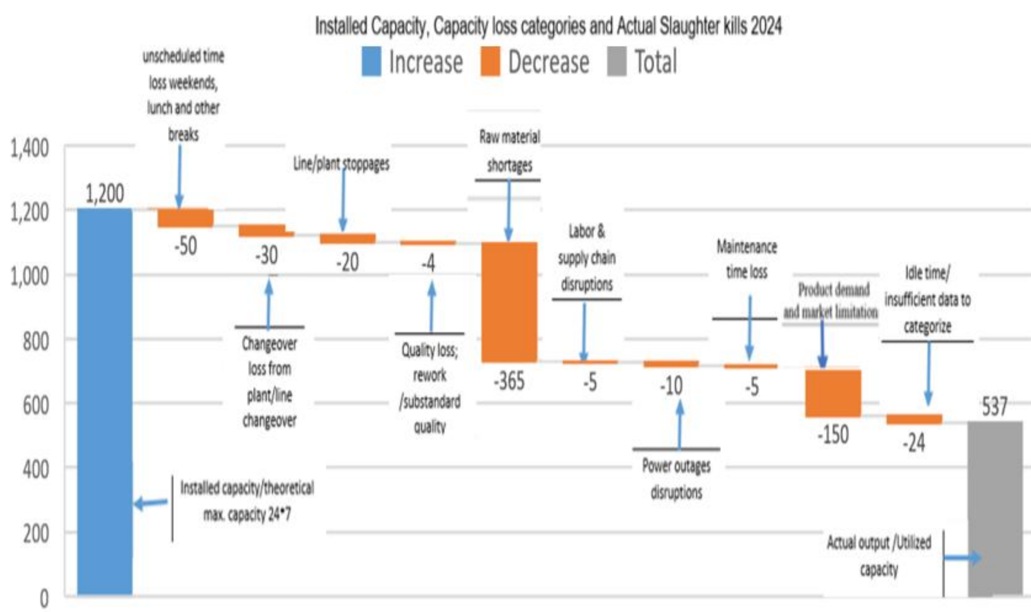



**Figure 29: Capacity utilisation and loss analysis 2024 – Beef Meat Processing Case Study #002@mw – medium-scale**

*Overall equipment effectiveness analysis*

At *Beef Meat Processing Case Study 002@mw – medium-scale* quality losses were reported at 4% of productive time over 8 hrs run time, 5 days a week. From the data collected and analysed the OEE performance for the company in the Year 2024 was reported as follows:


**Figure 30: Overall equipment effectiveness analysis 2024 – Beef Meat Processing Case Study #002@mw – medium-scale**

*Conclusive case findings*

Capacity utilisation reflects the efficiency of a production process by accounting for both productive and non-productive time, whereas Overall Equipment Effectiveness (OEE) focuses specifically on equipment efficiency during scheduled production periods. OEE serves as a diagnostic tool to identify and mitigate significant losses – such as breakdowns and defects – that hinder capacity utilisation. In practical terms, while high capacity utilisation signifies frequent machine operation, OEE provides insight into its effectiveness. For the *Beef Meat Processing Case 002@mw – medium-scale*, with a capacity utilisation rate of 43% and an OEE of 60%, there exists a considerable gap to reach the world-class OEE benchmark of 85%. This suggests that the company has significant untapped potential to improve performance and productivity by enhancing OEE, given its current operational parameters and resource constraints.

### 4.3.3 Conclusions: Beef processing in Malawi

Malawi's beef processing industry has a capacity utilisation problem, with some large processors operating far below their potential. Beef processing in Malawi is primarily driven by smallholder farmers and faces challenges, including low productivity and limited modern processing capacity. Despite government efforts to promote commercialisation and increase exports, the industry's potential is constrained by issues like inbreeding, poor infrastructure, and concerns about food traceability. However, there are opportunities for growth through the development of modern processing facilities, improved breeding programs, and integrating livestock with crop systems. To modernise and improve beef processing in Malawi, focus should be on beef cattle nutrition and management, upgrading infrastructure, enhancing food safety, and supporting smallholder farmers with targeted investments in feed and fodder production, technology, training, and market access. Key actions include investing in modern slaughtering and processing plants, developing effective traceability systems, strengthening animal nutrition research, promoting the cultivation of protein sources, and increasing access to capital for farmers and processors to meet international export standards.

## 4.6 Comparative beef meat processing capacity utilisation

The report reveals a relatively uniform picture of the beef processing industry in Kenya and Malawi. Kenya stands out for its more modern, export-oriented processing sector and better infrastructure, but, like Malawi, it still struggles with underused capacity due to inconsistent raw material supply and demand. In contrast, Malawi, is dominated by small-scale, informal processors who face outdated equipment, unreliable utilities, and fragmented markets, leading to even lower capacity utilisation, while Kenya has strong lead firms with significant export volumes. The data indicated both countries have a below average installed capacity utilisation at 39% and 40% for large and medium-scale beef processors respectively. Firms that maintained year-round operations typically operated for 4-6 days a week on a single 8 hour shift, highlighting the significant impact of unreliable raw material availability on capacity utilisation. Both countries beef industry is largely informal and operates at a minimal capacity, while Kenya has a more developed processing infrastructure, suggesting a higher, though still potentially underutilised, capacity. Overall, the survey findings emphasise the urgent need for improved access to raw materials, investment in infrastructure, and policy interventions that support both capacity utilisation and the modernisation of processing methods. Major obstacles across the two countries include high input costs, limited credit, and poor infrastructure. The survey underscores the need for investments in supply chain improvements, infrastructure, and supportive policies to increase capacity utilisation and foster industry modernisation. Addressing these systemic challenges is essential for enhancing the competitiveness and sustainability of the beef processing industry.

**Table 17: Summary of processing capacity and capacity utilisation of surveyed beef meat processing firms**

| Commodity | Agro-processing firm | Country | Scale | Installed processing capacity (Slaughter kills/year) | Actual capacity utilisation (Slaughter kills/year) | Percentage of capacity utilisation (Slaughter kills/year) |
|---|---|---|---|---|---|---|
| **Beef Meat Processing** | Case Study #001@ke | Kenya | Large | 86,400 | 33,284 | 39% |
| | Case Study #002@ke | Kenya | Medium | 1440 | 522 | 36% |
| | Case Study #001@mw | Malawi | Large | 30,000 | 11,696 | 39% |
| | Case Study #002@mw | Malawi | Medium | 1,200 | 511 | 43% |

## 4.7 Benchmarking on the beef processing sector

This survey recommends benchmarking in beef processing, emphasising its role in promoting efficiency, competitiveness, and sustainability in the African beef industry. Benchmarking involves comparing production systems, processing facilities, and practices to identify best practices, encourage improvements, and meet consumer and market demands.

Key areas highlighted include:

1. **Market development and competitiveness:** Benchmarking supports import substitution to strengthen local industries, explores export potential by learning from successful international models, and encourages supply chain optimisation to improve capacity utilisation and open new markets. The benchmarking study of Botswana's beef industry benchmarks itself globally through its reputation for high-quality, grass-fed, hormone-free beef, meeting rigorous international standards such as those of the European Union. The industry's strengths include its strong cultural heritage, a professionalised processing and export system via the Botswana Meat Commission (BMC), and its role as the country's second-largest export after diamonds.
2. **Beef production:** Benchmarks enable comparison across different production systems (such as cow-calf versus finishing), and assess animal performance (for example, weaning weights, growth rates), reproduction metrics (pregnancy and calving rates), and economic indicators (feed conversion, costs, and returns). This data-driven approach emphasises areas for increased profitability and efficiency.
3. **Beef processing:** Facility characteristics like slaughter rates and chain speeds are compared, alongside assessments of meat quality and yield (such as carcass grades and weights), and animal welfare indicators related to handling and pre-slaughter conditions.
4. **Strategic Interventions:** Government support, public-private partnerships, and livestock improvements are vital. Benchmarking international policy and support programs can drive effective interventions. Emphasis is also placed on improving energy efficiency, enhancing competitiveness, and promoting sustainability throughout the sector.
5. **Supporting ecosystem:** Robust data collection and analysis underpin successful benchmarking, enabling identification of best practices and capacity utilisation opportunities. Extension services can integrate benchmarking insights to provide farmers and processors with actionable, practical guidance.

Overall, the report underscores the power of benchmarking as a tool for continuous improvement in Africa's beef sector, driving resource efficiency, market growth, animal welfare, and sustainability.

# 5.0 Findings on dairy processing

Dairy processing in Africa faces significant challenges, including low milk production, a heavy reliance on imports, inadequate infrastructure, poor herd management, and limited access to formal markets. However, there are opportunities for enhancing productivity through the adoption of technology, improved breeds, and market development. Nonetheless, constraints such as feed shortages and disease prevalence impede progress. While formal processing capacities remain low, demand and consumption of long-life milk and fermented milk products, is transforming the market landscape.

## 5.1 Factors influencing capacity utilisation in dairy processing

The capacity utilisation of a dairy processing plant is a measure of how effectively it utilises its resources, encompassing metrics such as processed milk volume, operational efficiency, and potential output. Based on the survey findings, the challenges and bottlenecks affecting capacity utilisation in dairy processing include;

- **Seasonal fluctuations in milk production:** Milk supply can vary depending on the time of year and weather patterns.
- **Equipment downtime and maintenance:** Regular maintenance and unexpected breakdowns can reduce processing time.
- **Labor availability and productivity:** The number of skilled workers and their efficiency impact processing speed.
- **Market dynamics:** Changes in consumer demand, competition, and pricing can affect how much milk is processed.
- **Infrastructure:** The availability of reliable electricity, water, and transportation can affect processing capacity.
- **Equipment limitations:** Outdated or insufficient equipment, such as pasteurisation, homogenisation, or packaging machinery, can significantly limit processing capacity.
- **Fluctuating/insufficient milk supply:** Variations in milk supply, particularly during certain seasons or due to farmer issues, can cause disruptions and limit the ability to process milk at peak capacity. This is exacerbated by factors such as unreliable transportation and inadequate cold-chain and storage infrastructure.
- **Operational inefficiencies:** Poor milk handling practices, inadequate storage facilities, or inefficient cleaning and sanitation procedures can lead to quality issues and reduce processing capacity.
- **Market constraints:** Shifting consumer preferences, declining demand for certain products, or increased competition can also limit the need for increased processing capacity.
- **Data bottlenecks:** Inadequate data collection and analysis on milk quality, production volumes, and consumer preferences can hinder informed decision-making and capacity planning.
- **Separator bottleneck:** The process of separating milk into cream and skim milk can be a significant bottleneck in some dairy processing facilities.
- **Quality control issues:** Inadequate handling and storage of milk can lead to spoilage and contamination, impacting both product quality and consumer confidence.
- **Competition from imported goods:** Lower-priced dairy products from other countries can undercut local producers, affecting their market share and profitability.

- **Financial constraints:** Small-scale farmers may struggle to invest in better farming practices or technologies, limiting their milk production and impacting the overall supply chain.
- **Rise of plant-based dairy alternatives:** The increasing popularity of plant-based milk alternatives can reduce market share for traditional dairy products.

The pie chart below shows the weighted challenges and bottlenecks representing the proportional impact of various obstacles as cited by agro-processors in the dairy sector across size and country spectrum, with the size of each segment indicating its overall weight or significance.

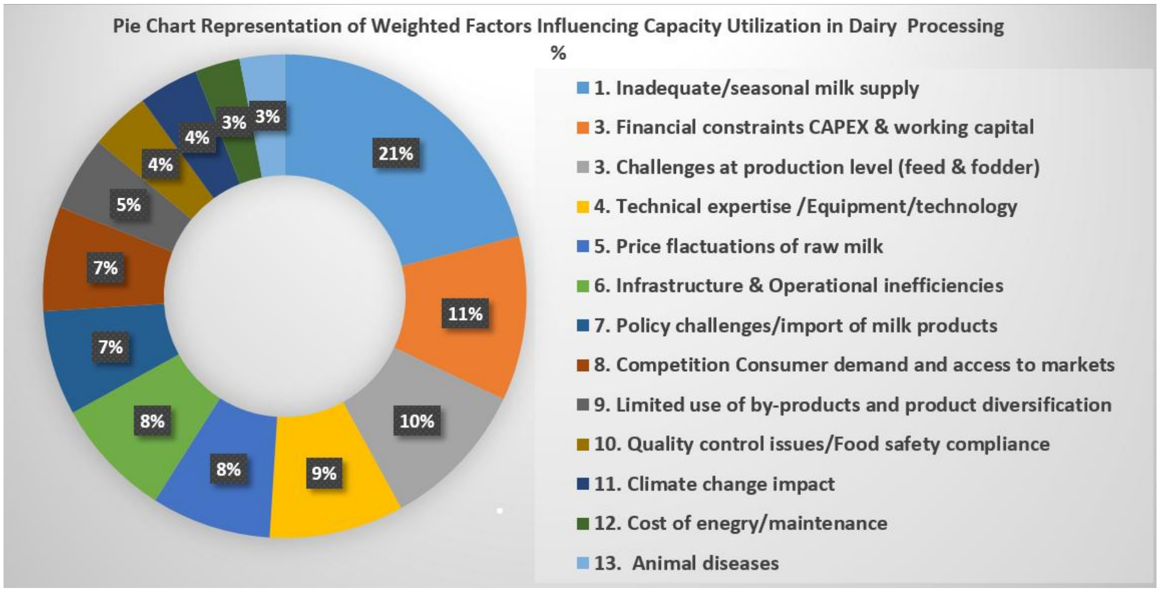



**Figure 31: Weighted factors influencing capacity utilisation in dairy processing**

## 5.2 Dairy processing in Kenya

The dairy industry in Kenya is a cornerstone of the country's economy, contributing 3% to 4% to GDP and serving as a vital source of livelihood for millions of smallholder farmers who produce over 80% of the nation's milk. The formal sector, dominated by cooperatives, processes around 1.5 billion litres annually – roughly 35% of the total national production. These cooperatives play a pivotal role by aggregating milk, offering training and credit, and facilitating market access, although private processors are also important sector players. Despite its strengths, the industry faces persistent challenges, including underutilised processing facilities and the adverse effects of climate change on milk yields. The industry also faces supply-side challenges, including fluctuating milk supply due to unpredictable weather, concerns about raw milk quality, competition from informal milk sales, and inadequate cold chain infrastructure, all of which affect overall capacity utilisation and efficiency. Notable players such as Brookside Dairy Limited, New KCC, Githunguri Dairy Farmers Cooperative, among others, contribute significantly to the sector through a range of dairy products.

### 5.2.1 Dairy Processing Case Study @ke 001 dairy – large-scale

*Dairy Processing Case Study @ke 001 Dairy* – established in 1967, this large-scale, farmer-owned milk processing company is based in Meru County, Kenya. The cooperative processes and markets various dairy products, including UHT milk, yogurt, mala, cream, and ghee. Its goal is to increase milk production from 406,000 litres to 1 million litres per day by 20230 and currently supports over 30,000 farmers. However, the cooperative faces several challenges, such as limited market power, distribution problems, competition from new processors, delays in paying farmers, aging equipment, and high raw milk spoilage rates.

**Table 18: Annual throughput year 2023 & 2024 – Dairy Processing Case Study #001@ke – large-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (litres/momth) | Output (litres per months) | Utilization rate (%) | Month | Installed/Design capacity (Tons) | Output (tons | Utilization rate (%) |
| Jan | 18,000,000 | 11,580,000 | 64 | Jan | 18,000,000 | 12,870,000 | 72 |
| Feb | 18,000,000 | 11,850,000 | 66 | Feb | 18,000,000 | 13,440,000 | 75 |
| March | 18,000,000 | 12,150,000 | 68 | March | 18,000,000 | 13,890,000 | 77 |
| April | 18,000,000 | 12,150,000 | 68 | April | 18,000,000 | 14,820,000 | 82 |
| May | 18,000,000 | 13,350,000 | 74 | May | 18,000,000 | 15,150,000 | 84 |
| June | 18,000,000 | 11,850,000 | 66 | June | 18,000,000 | 15,510,000 | 86 |
| July | 18,000,000 | 11,850,000 | 66 | July | 18,000,000 | 15,600,000 | 87 |
| August | 18,000,000 | 12,360,000 | 69 | August | 18,000,000 | 15,120,000 | 84 |
| September | 18,000,000 | 12,030,000 | 67 | September | 18,000,000 | 14,430,000 | 80 |
| October | 18,000,000 | 12,150,000 | 68 | October | 18,000,000 | 13,680,000 | 76 |
| November | 18,000,000 | 13,080,000 | 73 | November | 18,000,000 | 13,200,000 | 73 |
| December | 18,000,000 | 13,050,000 | 73 | December | 18,000,000 | 15,300,000 | 85 |
| Total | 216,000,000 | 147,450,000 | 68 | Total | 216,000,000 | 158,580,000 | 73 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =68%

Year 2024 =73%

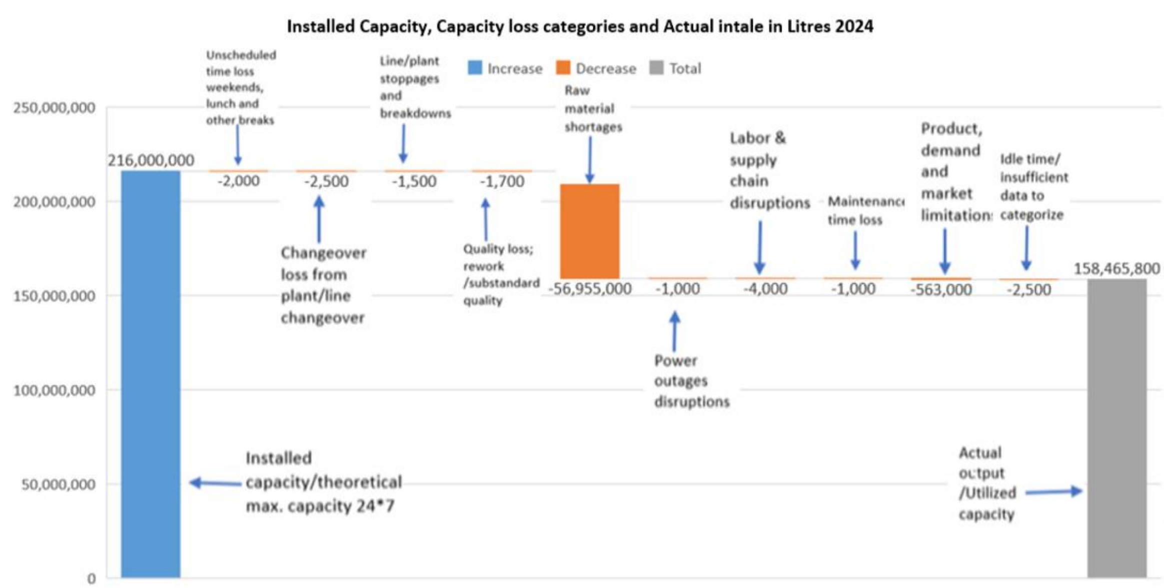



**Figure 32: Capacity utilisation and loss analysis 2024 – Dairy Processing Case Study #001@ke – large-scale**

*Overall equipment effectiveness analysis*

At *Dairy Processing Case study @ke 001 – large-scale*, quality losses were reported at 2% of productive time across 16 hours of runtime, 7 days a week. From the data collected and analysed, the OEE performance for the Cooperative in the Year 2024 was reported as follows:

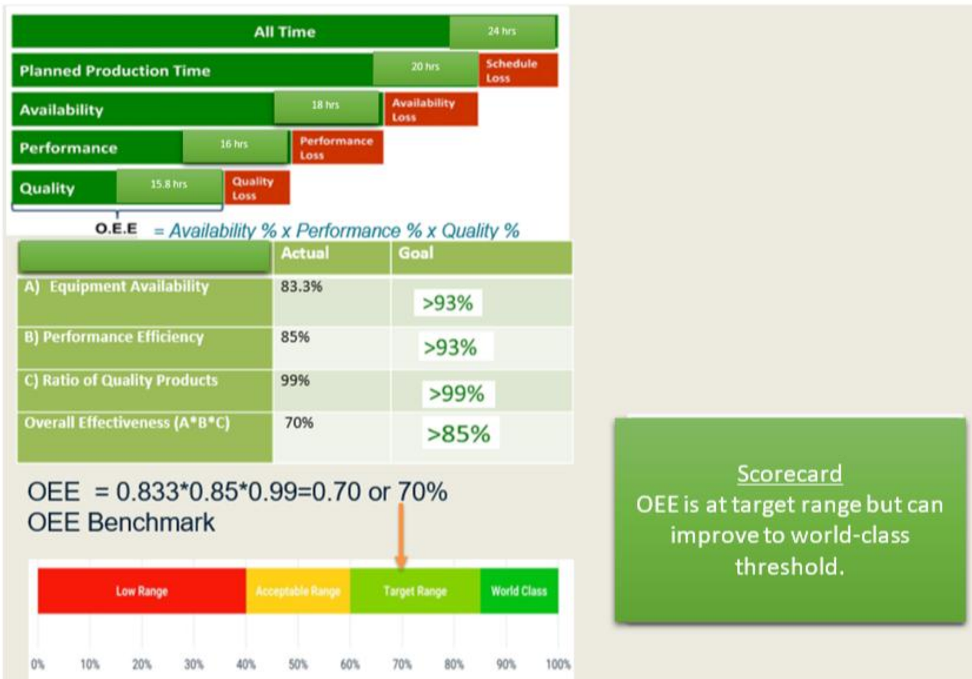



**Figure 33: Overall equipment effectiveness analysis 2024 – Dairy Processing Case Study #001@ke – large-scale**

*Conclusive case findings*

Capacity utilisation is essential in production, reflecting both productive and non-productive time. It assesses equipment efficiency during scheduled production and considers overall potential, including downtime. The OEE framework helps address significant losses that affect capacity, such as equipment breakdowns and defects. In 2024, *Dairy Processing Case study @ke 001 Dairy – large-scale* had a capacity utilisation rate of 73 % and an OEE of 70%. To achieve world-class OEE, the company must optimise its existing equipment and resources while addressing losses in availability, performance, and quality. By focusing on OEE components, the Cooperative can enhance efficiency and exploit untapped capacity.

### 5.2.2 Dairy Processing Case Study 002@ke – medium-scale

*Dairy Processing Case 002@ke – medium-scale*, founded in 2009, is a medium-tier entity in Kenya's dairy sector, known for its yoghurt products. Situated in Ndumberi, Kiambu County, the company collects between 10,000 and 15,000 litres of milk daily and is planning to install a long-life processing line to enhance its operations and respond to market demand dynamics.

**Table 19: Annual throughput year 2023 & 2024 – Dairy Processing Case Study #002@ke – medium-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (litres/momth) | Output (litres per months) | Utilization rate (%) | Month | Installed/Design capacity (litres) | Intake (litres) | Utilization rate (%) |
| Jan | 1,100,000 | 311,400 | 28.31 | Jan | 1,100,000 | 321,400 | 29.22 |
| Feb | 1,100,000 | 355,700 | 32.34 | Feb | 1,100,000 | 345,700 | 31.43 |
| March | 1,100,000 | 359,200 | 32.65 | March | 1,100,000 | 359,200 | 32.65 |
| April | 1,100,000 | 363,420 | 33.04 | April | 1,100,000 | 373,420 | 33.95 |
| May | 1,100,000 | 386,395 | 35.13 | May | 1,100,000 | 366,395 | 33.31 |
| June | 1,100,000 | 356,160 | 32.38 | June | 1,100,000 | 356,160 | 32.38 |
| July | 1,100,000 | 341,000 | 31.00 | July | 1,100,000 | 356,000 | 32.36 |
| August | 1,100,000 | 317,700 | 28.88 | August | 1,100,000 | 350,700 | 31.88 |
| September | 1,100,000 | 372,300 | 33.85 | September | 1,100,000 | 352,300 | 32.03 |
| October | 1,100,000 | 376,700 | 34.25 | October | 1,100,000 | 366,700 | 33.34 |
| November | 1,100,000 | 378,200 | 34.38 | November | 1,100,000 | 378,200 | 34.38 |
| December | 1,100,000 | 382,120 | 34.74 | December | 1,100,000 | 372,120 | 33.83 |
| Total | 13,200,000 | 4,300,295 | 32.58 | Total | 13,200,000 | 4,298,295 | 32.56 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =33%

Year 2024 =33%

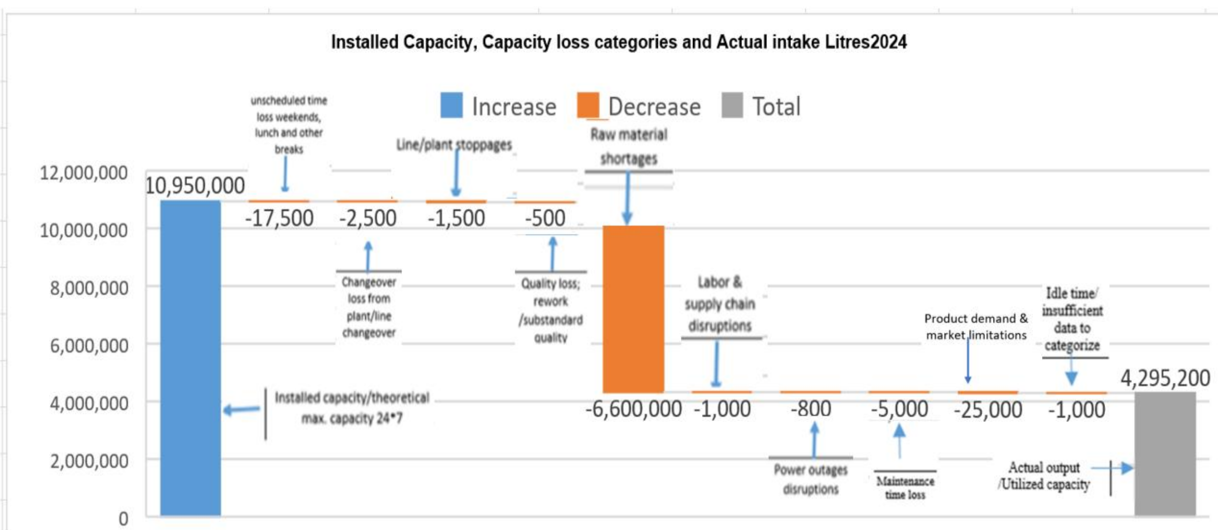



**Figure 34: Capacity utilisation and loss analysis 2024 – Dairy Processing Case Study #002@mw – medium-scale**

*Overall equipment effectiveness analysis*

At *Dairy Processing Case 002@ke – medium-scale*, quality losses were reported at 2% of productive time over 16 hours of operation, six days a week. Based on the collected and analysed data, the OEE performance for the company in 2024 was reported as follows:

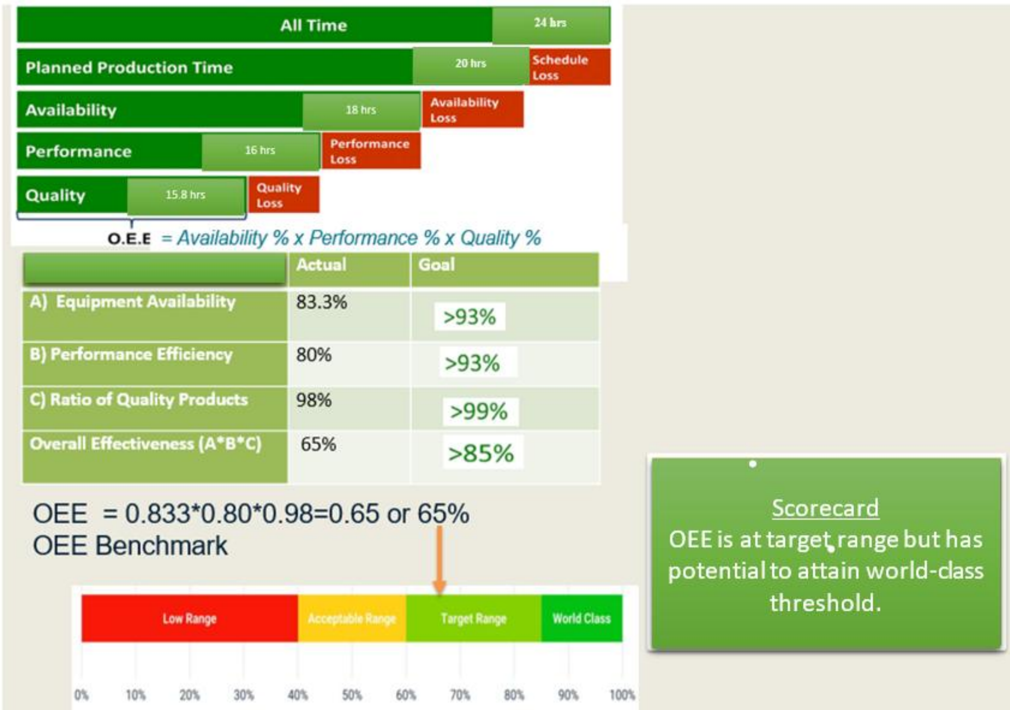



**Figure 35: Overall equipment effectiveness analysis – capacity utilisation and loss analysis 2024 – Dairy Processing Case Study #002@ke – medium-scale**

*Conclusive case findings*

Capacity utilisation measures production efficiency across both operational and non-operational times. In contrast, Overall Equipment Effectiveness (OEE) evaluates equipment performance during scheduled production, identifying losses termed the "six big losses" (breakdowns, setup adjustments, minor stops, reduced speed, defects, and startup rejects). At *Dairy Processing Case 002@ke – medium-scale*, capacity utilisation is 33% and OEE is 58%, which is 27 points below the world-class benchmark of 85%. This underperformance is mainly due to the operation of a single 8-hour shift daily. To enhance OEE and overall productivity, the company should consider transitioning to a 24/7 operation, focusing on minimising losses and scrutinising OEE factors to reduce unplanned stops and improve availability and capacity optimisation.

### 5.2.3 Conclusion: Dairy processing in Kenya

Kenya's dairy processing sector, while equipped with an installed capacity of 3.75 million litres per day across large to small processors, is currently underutilising its resources. While there is latent capacity to meet growing demand, the industry operates at a low utilisation rate, averaging around 40%. The sector plays a crucial economic role by supporting millions of smallholder farmers and contributing significantly to the country's GDP. However, it faces persistent challenges, including unreliable milk supply, poor rural infrastructure, fragmented value chains, and regulatory gaps. To address these issues, a government-led strategic roadmap is in place that emphasises modern climate-smart farming, advanced processing technologies, and improved rural logistics. Initiatives such as low-interest loans, feed subsidies, and the promotion of high-yielding livestock are designed to boost productivity and farmer incomes. The success of these efforts relies on stronger public-private partnerships, increased youth involvement, and better institutional coordination. With continued investment and reform, Kenya's dairy sector can realise its potential for greater efficiency, resilience, and capacity optimisation.

## 5.3 Dairy processing in Malawi

Significant challenges and emerging opportunities characterise the milk processing industry in Malawi. Despite operating at a low capacity utilisation rate, the sector is experiencing growth, primarily driven by approximately 55,000 smallholder farmers who collectively produce about 40 million litres of milk annually. However, only half of this milk enters the formal processing sector, with the remainder consumed informally. Key constraints hindering progress include inadequate foundation stock, low milk yields due to health and feeding issues, poor farm-level hygiene, and limited access to clean water, reliable energy, and extension services. The processing side also grapples with unreliable cooling chain, insufficient water and energy supply, and unreliable forex. Despite these obstacles, the industry is showing promise, especially with investments in modern facilities by leading companies such as Lilongwe Dairies, Suncrest Creameries, and Mzuzu Dairy, all of which work closely with smallholder farmers. The sector's future growth depends on improving infrastructure, adopting innovative breeding and management practices, and strengthening the value chain to boost both quality and capacity.

### 5.3.1 Dairy Processing Case Study 001@mw – large-scale

Dairy Processing Case 001@mw – large-scale a leading dairy processor in Malawi, specialising in UHT milk, yoghurt, juice blends, butter, cheese, and cream. The company commands over 60% of the processed milk market share in the country. Its primary suppliers are smallholder dairy farmers. The company has enhanced its processing capabilities while fostering stronger business relationships with these farmers through various production improvement initiatives and robust milk collection centres.

**Table 20: Annual throughput year 2023 & 2024 – Dairy Processing Case Study #001@mw – large-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (litres/month) | Intake (litres per month) | Utilization rate (%) | Month | Installed/Design capacity (Litres/month) | Intake Litres/Month | Utilization rate (%) |
| Jan | 4,500,000 | 2,201,000 | 49 | Jan | 4,500,000 | 2,800,000 | 62 |
| Feb | 4,500,000 | 2,201,000 | 49 | Feb | 4,500,000 | 2,800,000 | 62 |
| March | 4,500,000 | 2,201,000 | 49 | March | 4,500,000 | 2,800,000 | 62 |
| April | 4,500,000 | 2,201,000 | 49 | April | 4,500,000 | 2,800,000 | 62 |
| May | 4,500,000 | 2,201,000 | 49 | May | 4,500,000 | 2,800,000 | 62 |
| June | 4,500,000 | 2,201,000 | 49 | June | 4,500,000 | 2,800,000 | 62 |
| July | 4,500,000 | 2,201,000 | 49 | July | 4,500,000 | 2,800,000 | 62 |
| August | 4,500,000 | 2,201,000 | 49 | August | 4,500,000 | 2,800,000 | 62 |
| September | 4,500,000 | 2,201,000 | 49 | September | 4,500,000 | 2,800,000 | 62 |
| October | 4,500,000 | 2,201,000 | 49 | October | 4,500,000 | 2,800,000 | 62 |
| November | 4,500,000 | 2,201,000 | 49 | November | 4,500,000 | 2,800,000 | 62 |
| December | 4,500,000 | 2,201,000 | 49 | December | 4,500,000 | 2,800,000 | 62 |
| Total | 54,000,000 | 26,412,000 | 49 | Total | 54,000,000 | 30,800,000 | 57 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =49%

Year 2024 =57%

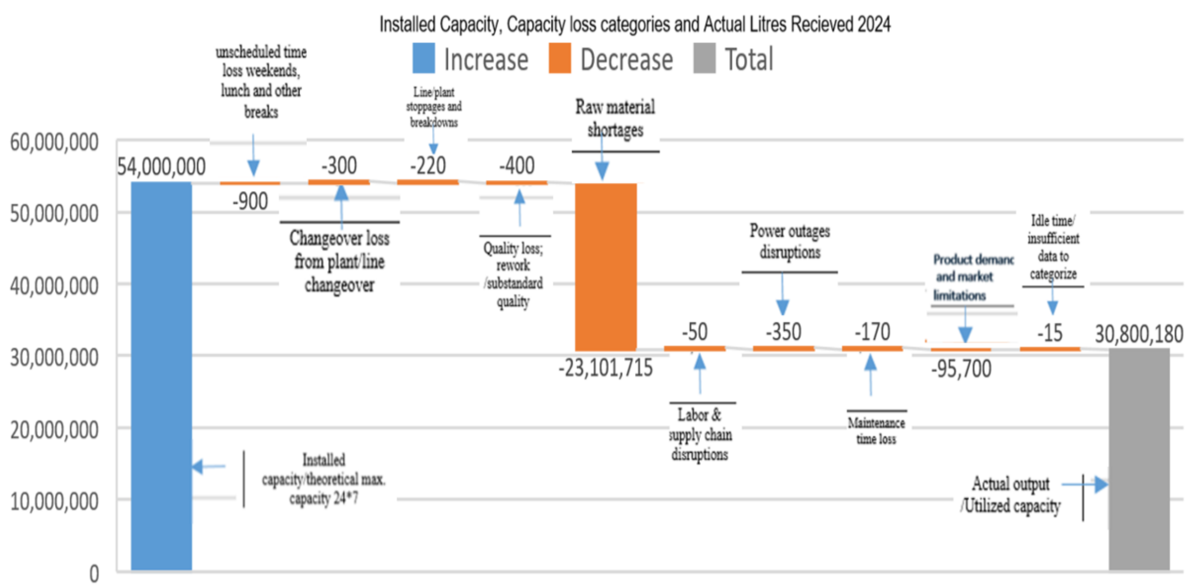



**Figure 36: Capacity utilisation and loss analysis 2024 – Dairy Processing Case Study #001@mw – large-scale**

*Overall equipment effectiveness analysis*

At *Dairy Processing Case 001@mw – large-scale*, quality losses were reported at 1% of productive time across 16 hours of runtime, 7 days a week. From the data collected and analysed the OEE performance for the company in the Year 2024 was reported as follows:

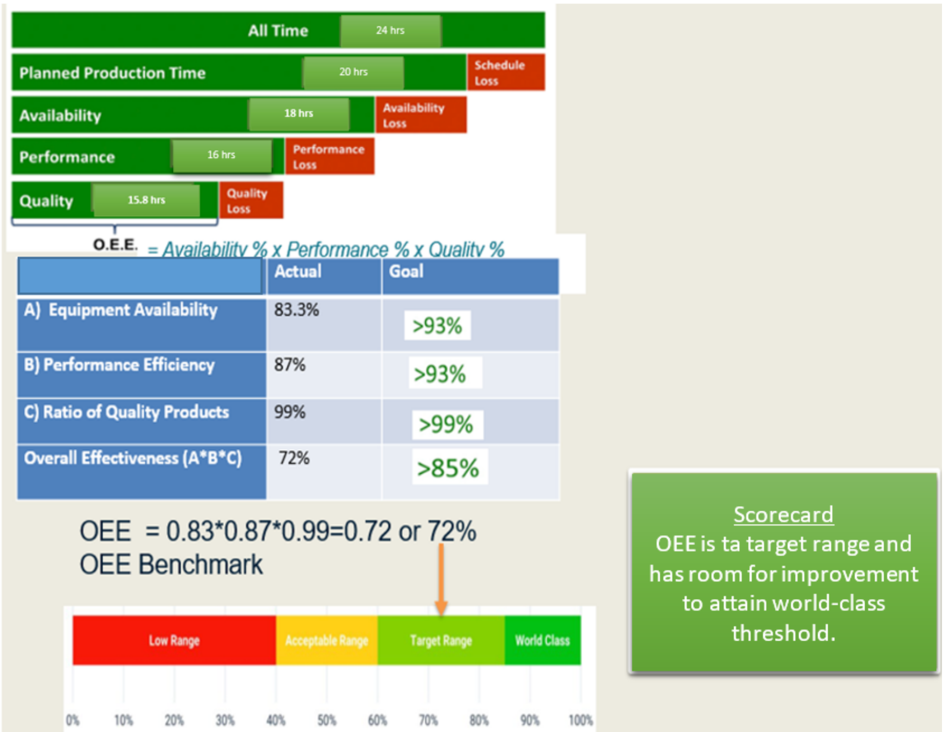



**Figure 37: Overall equipment effectiveness analysis – capacity utilisation and loss analysis 2024 – Dairy Processing Case Study #001@mw – large-scale**

*Conclusive case findings*

Capacity utilisation assesses production efficiency over both operational and non-operational periods, while Overall Equipment Effectiveness (OEE) focuses on equipment performance during scheduled production, accounting for various downtimes. OEE uncovers significant efficiency losses known as the "six big losses": breakdowns, setup adjustments, minor stops, reduced speed, defects, and startup rejects. At *Dairy Processing Case Study 001@mw – large-scale*, current capacity utilisation is at 57% and OEE is at 72%, falling 13 points below the world-class benchmark of 85%. This lack of performance is primarily due to operating a single 8-hour shift daily. To improve OEE and overall production, the company focus supporting farmer-producer base and analysing OEE components, especially to enhance availability and capacity optimisation.

### 5.3. Dairy Processing Case Study 002@mw – medium-scale

*Dairy Processing Case 002@mw – medium-scale* is located in Mzuzu region, Malawi the company has established an effective route-to-market system for smallholder farmers, currently comprising a network of 5,000 farmers. The company actively monitors their progress through the deployment of extension workers, which enhances productivity and ensures the production of high-quality milk, thereby complementing existing government support systems.

**Table 21: Annual throughput year 2023 & 2024 – Dairy Processing Case Study #002@mw – medium-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (litres/momth) | Output (litres per months) | Utilization rate (%) | Month | Installed/Design capacity (Tons) | Output (tons | Utilization rate (%) |
| Jan | 240,000 | 100,010 | 42 | Jan | 240,000 | 102,660 | 43 |
| Feb | 240,000 | 99,200 | 41 | Feb | 240,000 | 123,460 | 51 |
| March | 240,000 | 97,440 | 41 | March | 240,000 | 102,340 | 43 |
| April | 240,000 | 94,560 | 39 | April | 240,000 | 98,660 | 41 |
| May | 240,000 | 89,000 | 37 | May | 240,000 | 110,660 | 46 |
| June | 240,000 | 87,200 | 36 | June | 240,000 | 109,260 | 46 |
| July | 240,000 | 84,450 | 35 | July | 240,000 | 107,860 | 45 |
| August | 240,000 | 84,600 | 35 | August | 240,000 | 105,760 | 44 |
| September | 240,000 | 80,200 | 33 | September | 240,000 | 103,660 | 43 |
| October | 240,000 | 78,900 | 33 | October | 240,000 | 102,660 | 43 |
| November | 240,000 | 80,100 | 33 | November | 240,000 | 101,240 | 42 |
| December | 240,000 | 80,500 | 34 | December | 240,000 | 105,560 | 44 |
| Total | 2,880,000 | 1,056,160 | 37 | Total | 2,880,000 | 1,170,120 | 41 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =37%

**Year 2024 =41%**

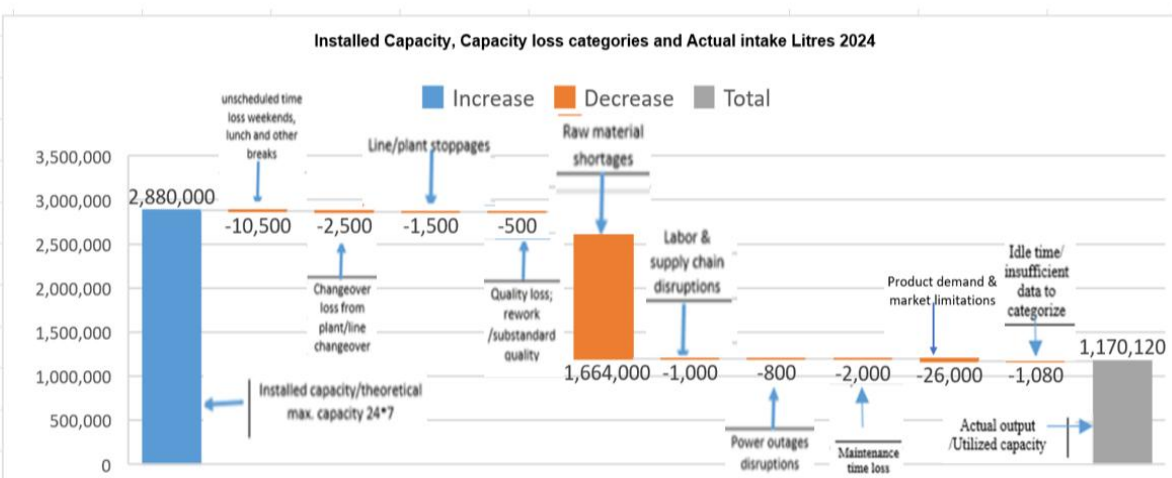



**Figure 38: Capacity utilisation and loss analysis 2024 – Dairy Processing Case Study #002@mw – medium-scale**

*Overall equipment effectiveness analysis*

In *Dairy Processing Case 002@mw – medium-scale*, quality losses were reported as 1% of productive time over a 16-hour run, six days a week. Based on the data collected and analysed, the company's OEE performance for the year 2024 was documented as follows:

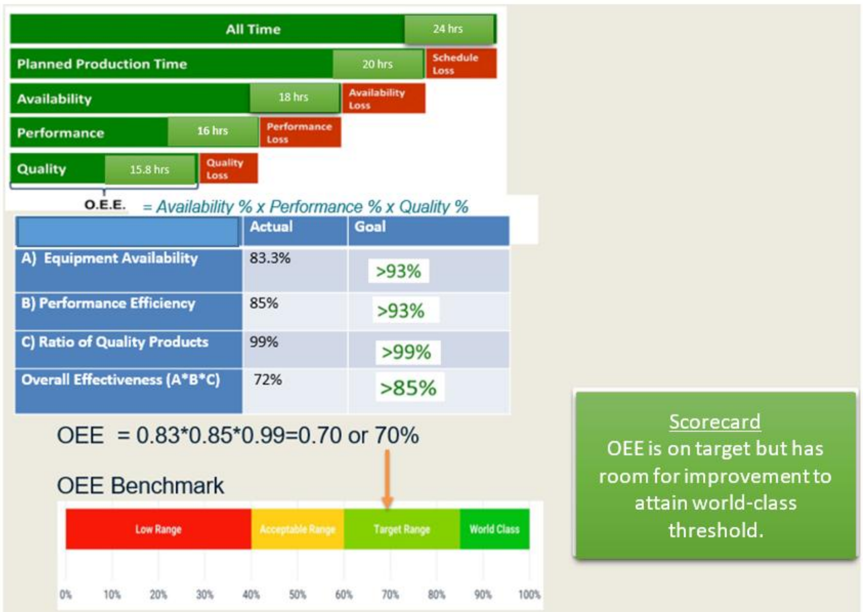



**Figure 39: Overall equipment effectiveness analysis – capacity utilisation and loss analysis 2024 – Dairy Processing Case Study #002@mw – medium-scale**

*Conclusive case findings*

At *Dairy Processing Case 002@mw – medium-scale*, the current capacity utilisation is 57%, with an Overall Equipment Effectiveness (OEE) of 72%, which is significantly below the world-class benchmark of 85%. Capacity utilisation measures production efficiency during both operational and non-operational periods, while OEE evaluates equipment performance during scheduled production, considering various downtime periods. The OEE metric exposes notable efficiency losses, categorised as the "six big losses": breakdowns, setup adjustments, minor stoppages, reduced speed, defects, and startup rejects. To enhance OEE and overall production, the company should adopt a 24/7 operational model, focus on reducing losses, and analyse OEE components closely to minimise unplanned stoppages, thus increasing equipment availability and capacity.

### 5.3.3 Conclusions: Dairy processing in Malawi

The Malawian dairy processing sector remains underdeveloped, hampered by low milk yields from a predominance of small-scale and informal milk markets. The low capacity is driven by a fundamental problem of unreliable and inconsistent milk supply from smallholder farmers, who are the primary milk producers in Malawi. Despite a relatively high installed processing capacity, only about 50% of this capacity is utilised due to insufficient local milk production, much of which stems from poor livestock genetics and persistent challenges such as foreign exchange shortages. These forex constraints inflate the costs of importing necessary inputs and dairy products, forcing the country to import approximately

35% of its dairy needs even though there is capacity to produce more locally. The sector is further limited by inefficiencies and high transaction costs throughout the value chain. To overcome these obstacles and reduce reliance on imports, Malawi must invest in medium-scale processing facilities and improved technologies. Such investments would boost milk surplus utilisation, expand product diversity, and improve forex availability to anchor the dairy sector for sustainable development.

## 5.4 Dairy processing in Nigeria

Nigeria faces a significant dairy demand-supply gap, with local production supplying only about 40% of consumption, resulting in annual import costs surpassing $500 million. The dairy sector struggles with low productivity and reliance on informal markets, though growth is evident in the processing segment, especially in southern Nigeria, driven by increased local milk production and investments in processing facilities. Efforts are ongoing to achieve self-sufficiency and cut dependence on imported powdered milk. Key areas for improvement include genetics, fodder quality, farmer education, and developing integrated processing and distribution systems to meet rising consumer demand. The market offers various dairy products, including fresh, powdered, and reconstituted milk, as well as yogurt, mostly made from imported milk powder. Major companies such as FrieslandCampina, L&Z Integrated Farms, NANTS Milk Factory, Chi Limited, Fan Milk PLC, Promasidor, Integrated Dairies, and Arla Foods are all engaging in backward integration programs to support local dairy farmers.

### 5.4.1 Dairy Processing Case Study 001@ng – large-scale

*Dairy Processing Case 001@ng – large-scale* is a Nigerian company established in 2003, specialising in the production and processing of fresh milk and dairy products. The company operates on a 550-hectare farm and processing facility situated in Vom, Plateau State, Nigeria.

**Table 22: Annual throughput year 2023 & 2024 – Dairy Processing Case Study #001@ng – large-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (litres/momth) | Intake (litres per months) | Utilization rate (%) | Month | Installed/Design capacity (Litres/month) | Intake Litres/Month | Utilization rate (%) |
| Jan | 600,000 | 225,000 | 38 | Jan | 600,000 | 267,800 | 45 |
| Feb | 600,000 | 257,800 | 43 | Feb | 600,000 | 277,700 | 46 |
| March | 600,000 | 288,300 | 48 | March | 600,000 | 288,500 | 48 |
| April | 600,000 | 299,600 | 50 | April | 600,000 | 269,500 | 45 |
| May | 600,000 | 289,800 | 48 | May | 600,000 | 255,830 | 43 |
| June | 600,000 | 267,800 | 45 | June | 600,000 | 249,850 | 42 |
| July | 600,000 | 257,700 | 43 | July | 600,000 | 259,800 | 43 |
| August | 600,000 | 278,500 | 46 | August | 600,000 | 257,800 | 43 |
| September | 600,000 | 243,900 | 41 | September | 600,000 | 257,700 | 43 |
| October | 600,000 | 235,830 | 39 | October | 600,000 | 248,500 | 41 |
| November | 600,000 | 249,850 | 42 | November | 600,000 | 243,900 | 41 |
| December | 600,000 | 250,050 | 42 | December | 600,000 | 248,120 | 41 |
| Total | 7,200,000 | 3,144,130 | 44 | Total | 7,200,000 | 3,125,000 | 43 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

| Year 2023 | Year 2024 |
|---|---|
| =44% | =43% |

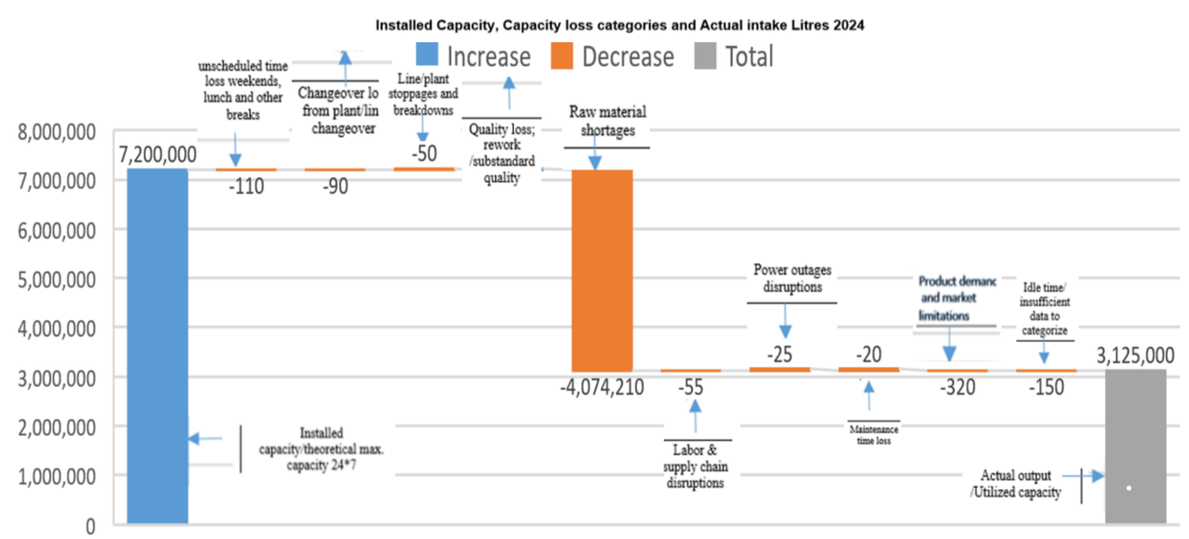



**Figure 40: Capacity utilisation and loss analysis 2024 – Dairy Processing Case Study #001@ng – large-scale**

*Overall equipment effectiveness analysis*

At *Dairy Processing Case 001@ng – large-scale*, quality losses were reported at 2% of productive time over 16 hours of run time, 6 days a week. From the data collected and analysed the OEE performance for the company in the Year 2024 was reported as follows:


**Figure 41: Capacity utilisation and loss analysis 2024 – Dairy Processing Case Study #001@ng – large-scale**

*Conclusive case findings*

At *Dairy Processing Case 001@ng – large-scale*, capacity utilisation currently stands at 57%, with Overall Equipment Effectiveness (OEE) at 72%, significantly below the desired world-class benchmark of 85%. This underperformance is largely attributed to the operation of a single 8-hour shift. Capacity utilisation measures production efficiency during both operational and non-operational periods, while OEE evaluates equipment performance during scheduled production and highlights various downtime causes, referred to as the "six big losses." To enhance OEE and overall production efficiency, the company should consider transitioning to a 24/7 operational model, focusing on minimising losses and thoroughly analysing OEE components to reduce unplanned stops, thereby improving availability and capacity optimisation.

### 5.4.2 Dairy Processing Case Study 002@ng – medium-scale

*Dairy Processing Case 002@ng – medium-scale* was founded in 2003 and is located in Minna, Nigeria. The company has its own farm covering over 700 hectares and is in the process of onboarding out-grower farmers.

**Table 23: Annual throughput year 2023 & 2024 – Dairy Processing Case Study #002@ng – medium-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (litres/month) | Output (litres per months) | Utilization rate (%) | Month | Installed/Design capacity (litres/month) | Output (litres per months) | Utilization rate (%) |
| Jan | 180,000 | 60,000 | 33 | Jan | 180,000 | 65,000 | 36 |
| Feb | 180,000 | 60,000 | 33 | Feb | 180,000 | 67,600 | 38 |
| March | 180,000 | 60,000 | 33 | March | 180,000 | 66,000 | 37 |
| April | 180,000 | 60,000 | 33 | April | 180,000 | 69,000 | 38 |
| May | 180,000 | 72,000 | 40 | May | 180,000 | 74,000 | 41 |
| June | 180,000 | 76,000 | 42 | June | 180,000 | 77,000 | 43 |
| July | 180,000 | 80,500 | 45 | July | 180,000 | 79,500 | 44 |
| August | 180,000 | 75,400 | 42 | August | 180,000 | 78,400 | 44 |
| September | 180,000 | 67,500 | 38 | September | 180,000 | 77,500 | 43 |
| October | 180,000 | 66,400 | 37 | October | 180,000 | 76,400 | 42 |
| November | 180,000 | 60,500 | 34 | November | 180,000 | 73,500 | 41 |
| December | 180,000 | 58,800 | 33 | December | 180,000 | 68,600 | 38 |
| Total | 2,160,000 | 797,100 | 37 | Total | 2,160,000 | 872,500 | 40 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =37%

Year 2024 =40%

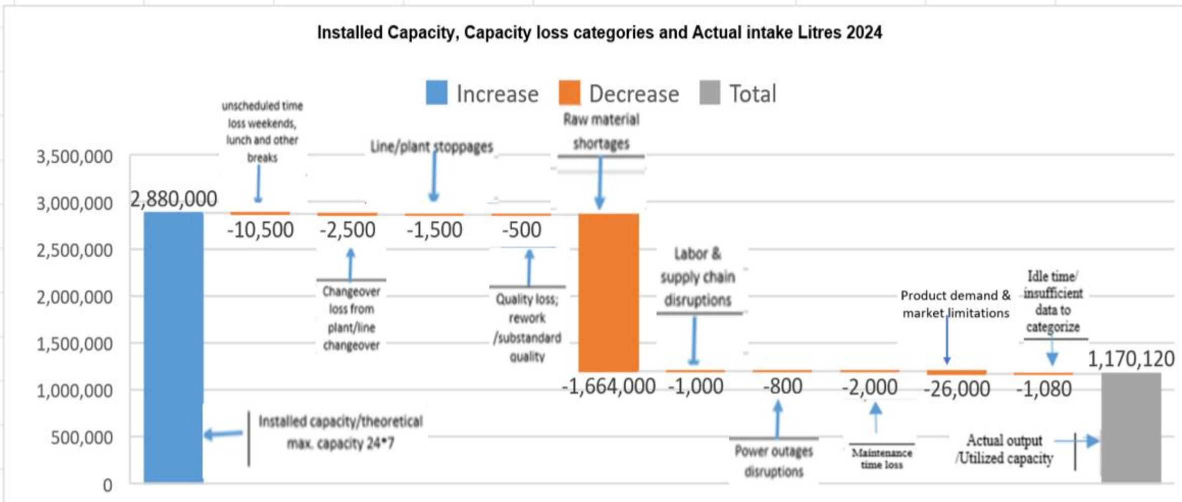



**Figure 42: Overall equipment effectiveness analysis – capacity utilisation and loss analysis 2024 – Dairy Processing Case Study #001@ng – large-scale**

*Overall equipment effectiveness analysis*

At *Dairy Processing Case Study #002@ng – medium-scale*, quality losses were reported at 2% of productive time over 16 hours of run time, 6 days a week. From the data collected and analysed the OEE performance for the company in the Year 2024 was reported as follows:

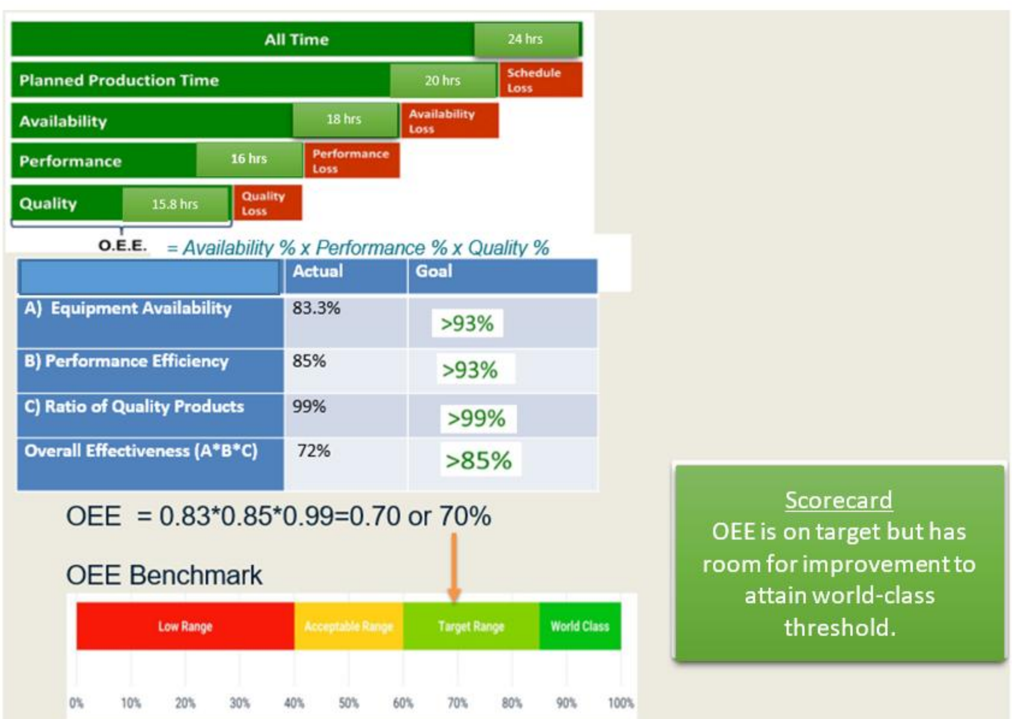



**Figure 43: Capacity utilisation and loss analysis 2024 – Dairy Processing Case Study #002@ng – medium-scale**

*Conclusive findings*

At *Dairy Processing Case Study #002@ng – medium-scale*, capacity utilisation currently stands at 40%, with Overall Equipment Effectiveness (OEE) at 70%, significantly below the desired world-class benchmark of 85%. This underperformance is largely attributed to the operation of a single 8-hour shift. Capacity utilisation measures production efficiency during both operational and non-operational periods, while OEE evaluates equipment performance during scheduled production and highlights various downtime causes, referred to as the "six big losses." To enhance OEE and overall production efficiency, the company should consider transitioning to a 24/7 operational model, focusing on minimising losses and thoroughly analysing OEE components to reduce unplanned stops, thereby improving availability and capacity optimisation.

## 5.6 Comparative dairy processing capacity utilisation

The survey report reveals that dairy processing capacity utilisation varies considerably across Kenya, Malawi and Nigeria, primarily due to differences in raw milk supply, processing capacity, and market demand. Kenya boasts high demand and substantial processing potential, yet supply challenges often limit full utilisation. Large-scale processors in Kenya have a robust processing capacity with the surveyed case showing a healthy 73% capacity utilisation which compares well with the peers. In contrast, Malawi and Nigeria operates with a relatively small processing capacity, utilising less than half of installed processing capacity because of limited local milk supply. Nigeria and Malawi's processors depend heavily on imported milk powder, reflecting both low domestic utilisation and persistent demand. Nigeria, despite having significant processing capacity, processes only a small proportion of its national milk production locally, with the majority sourced from imports. The average capacity utilisation rate reported was 58% for large tiers and 38% for large and medium category processors respectively, with underutilisation most pronounced in Kenya within the medium tier category at 33% owing to stiff competition from large-scale established dairies similarly lower in Malawi (41%) for medium tier dairy processor. The main barriers to optimal utilisation include raw material shortages, expensive distribution logistics for processed products, growing demand for long-life milk (where middle-tier processors have a challenge) and inconsistent power supply. Firms that manage continuous operations typically have backup energy sources and the ability to store raw materials, highlighting the importance of supply chain resilience for sustained productivity.

**Table 24: Comparative summary of dairy processing firms' capacity utilisation**

| Commodity | Agro-processing firm | Country | Scale | Average installed processing capacity (Litres/year) | Actual capacity utilisation (Litres/year) | Percentage of capacity utilisation (Litres)/year) |
|---|---|---|---|---|---|---|
| Dairy Processing | Case Study #001@ke | Kenya | Large | 216,000,000 | 158,000,000 | 73% |
| | Case Study #002@ke | Kenya | Medium | 13,200,00 | 4,298,295 | 33% |
| | Case Study #001@mw | Malawi | Large | 54,000,000 | 30,800,000 | 57% |
| | Case Study #002@mw | Malawi | Medium | 2,880,000 | 1,170,000 | 41% |
| | Case Study #001@ng | Nigeria | Large | 7,200,000 | 3,125,000 | 43% |
| | Case Study #002@ng | Nigeria | Medium | 2,160,000 | 872,500 | 40% |

## 5.7 Benchmarking opportunities in the dairy processing sector

The survey of dairy processing facilities in Kenya, Malawi, Ghana, and Nigeria uncovers significant disparities in processing capacity, technological advancement, and market integration. Nigeria and Kenya boast more developed dairy sectors, attributed to better infrastructure and supportive policies, while Malawi continues to struggle with low productivity, high operational costs, and a predominance of informal milk processing. In Kenya, for example, the surveyed large-scale processor reported a robust 73% capacity utilisation, while large tier in Malawi and Ghana, though smaller in terms of throughput, posted 57% and 43% actual capacity utilisation, respectively. All the medium-tier milk processors in the 3 countries are struggling towards below 40% – a trend that can be attributed to financial capacity and market power. Kenya emerges as a leader, with a robust value chain, substantial economic contributions, and enabling frameworks such as the National Dairy Master Plan and strong dairy cooperatives. Despite ongoing issues – particularly concerning feed quality and infrastructure – Kenya's dairy cooperatives model offers valuable lessons for other African nations aiming to modernise and strengthen their dairy industries.

To drive improvements in the sector, the survey highlights several benchmarking areas:

- **Cooperatives model:** Dairy farmers' cooperatives as an accelerator to collective action and shared benefits as witnessed in Kenyan can provide a learning platform for emerging dairy industries in Africa.
- **Farm productivity:** Raising milk yields through adoption of best practices in feeding, genetics, cow comfort and disease management is crucial and thus need to benchmark with advanced dairy farms within and outside the survey countries.
- **Processing efficiency:** Increasing processing efficiency by implementing advanced technologies and minimising waste is vital.

- **Supply chain optimisation:** Optimising supply chains for timely milk collection, transport, and distribution is key. Cooperative model and network of collection centres including farmer clustering can be beneficial to emerging dairy industries.
- **Leveraging on processor associations** – such as those in the Netherlands and South Africa for benchmarking on quality assurance and policy development, can be beneficial to emerging markets.

Overall, while there are considerable obstacles, adopting proven strategies and targeted benchmarking can help less advanced dairy sectors in Africa move toward greater efficiency, sustainability, and growth.

# 6.0 Findings on cashew processing

The survey findings on cashew processing industry in Ghana and Nigeria highlights a striking gap between the countries' large production base of raw cashew nuts (RCN) and its low local processing rates. While Africa leads in RCN production, most nuts are exported unprocessed to countries such as Vietnam and India, making it difficult for African processors to secure sufficient raw materials. This issue, compounded by the high capital and infrastructure investments required for processing, results in many facilities operating far below their capacity. Key bottlenecks identified include; inadequate financing, basic technology, competition from efficient Asian processors, limited market access, and difficulties in meeting international quality standards. High-interest rates and a lack of affordable loans further restrict investment, while insufficient government support, poor infrastructure, and a shortage of skilled labour also constrain growth. The report notes several opportunities for improvement, including increasing local processing through modernising processing plants with advanced technology, strengthening government support through favourable policies and incentives, improving market access, fostering regional collaboration, and investing in workforce training to enhance quality and efficiency.

## 6.1 Factors influencing cashew processing capacity utilisation

The survey findings on cashew nut processing in Ghana and Nigeria reveal that capacity utilisation in the sector is low, mainly due to inconsistent supply of raw materials, poor infrastructure, and high seasonality. Additional challenges include limited access to finance, high operational costs, inconsistent government policies, strict quality requirements, and a lack of technical expertise and modern equipment. The survey found that firms' capacity utilisation is declining towards below average capacity with notable cases having totally closed down. Factors influencing capacity utilisation include;

1. Supply-side factors
   - **Seasonality and raw material availability:** Inconsistent supply due to poor infrastructure, like a lack of access roads, and the seasonality of cashew nut production, can disrupt processing schedules.
   - **Logistics and transportation:** Inadequate infrastructure, particularly poor roads, can make it difficult to transport raw nuts to processing plants, especially during the rainy season.
   - **Quality of raw materials:** Variations in the quality and condition of raw cashews can affect the efficiency and profitability of the processing plant.
   - **Low out-turn:** A large portion of Africa's cashew production, especially in West Africa, is exported as raw nuts, resulting in significant value loss from minimal local processing and low-quality nuts left for local processors, leading to low out-turn.
   - **Dominance of Asian processors:** India and Vietnam, as key importers of African raw cashew nuts (RCN), hold substantial global processing capacity, thereby reaping most of the value-added benefits.
2. Demand-side factors
   - **Market access and information:** Limited access to market information and poor linkages to international markets for processed cashew kernels restrict demand.
   - **Quality and certification:** Stringent quality and food safety standards required by international buyers, and a lack of local certification mechanisms can be a major barrier.

- **Use of by-products:** The processing of cashews generates various byproducts that can be repurposed, presenting opportunities for additional revenue and waste reduction.

3. Operational, policy, and financial factors
    - **Limited financial resources/CAPEX and working capital:** Inconsistent access to credit and capital can hinder investment in machinery and capacity expansion.
    - **Inconsistent government policies:** A lack of supportive policies, such as stable tax regimes or incentives for local processing, stifles the growth of local cashew processing.
    - **High operating costs:** Elevated expenses due to unreliable electricity supply and other inputs raise overall operational costs.
    - **Operational challenge:** Access to raw materials, market pricing for products, and processing efficiency impact capacity utilisation rates significantly.
    - **Labor-intensive operations:** Many processing units rely heavily on labour-intensive methods, posing challenges regarding worker welfare and safety.
4. Technical and human resource factors
    - **Lack of technical skills:** A shortage of trained personnel and limited access to reliable training facilities can impact efficiency.
    - **Outdated technology:** A shortage of modern processing equipment and technology limits the ability to boost production capacity and meet quality standards.
    - **Labor-intensive operations:** Many processing units rely heavily on labour-intensive methods, posing challenges regarding worker welfare and safety.

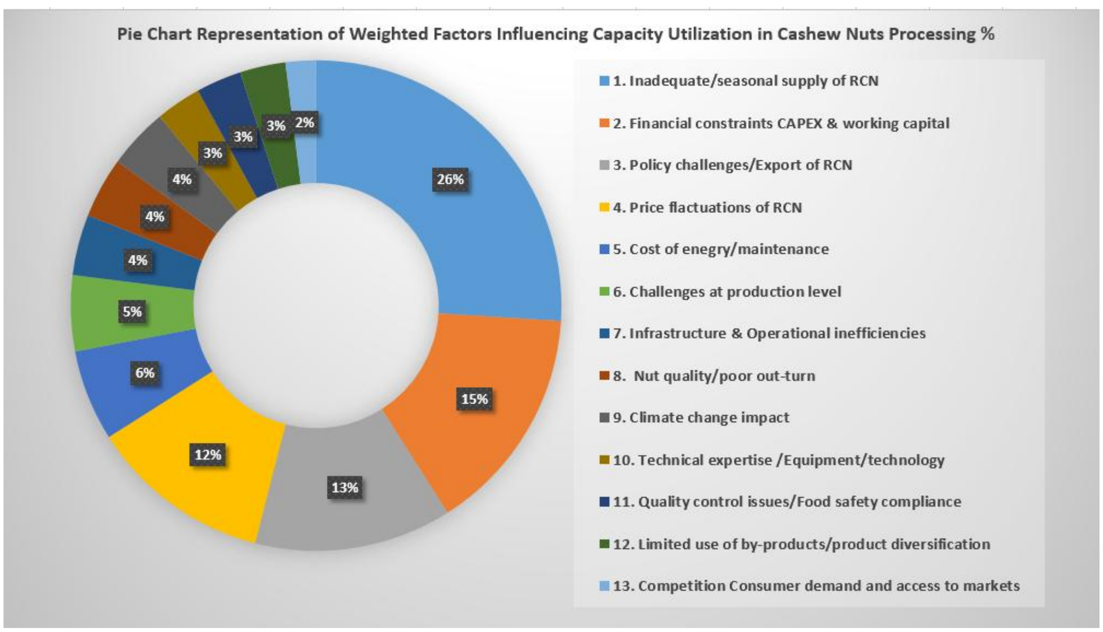



**Figure 44: Weighted factors influencing cashew processing capacity utilisation**

There is considerable potential for enhancing capacity utilisation through deliberate efforts to promote local processing, optimisation of processing techniques, improved energy efficiency, and enhanced supply chain management.

## 6.2 Cashew nuts processing in Ghana

Ghana's cashew sector has grown notably, making the country a significant player in Africa's cashew exports. However, most cashew nuts are exported raw, missing opportunities for local value addition, job creation, and increased foreign exchange. The industry features several processing companies, such as Mim Cashew, USIBRAS Ghana, and Agroking Limited, but only a small portion of cashew output is processed locally due to challenges like limited raw nut access, infrastructure gaps, and financing issues. The government has recently introduced policies to encourage domestic processing by support investments and stabilising raw nut supply. While progress has been made, the sector's future growth depends on attracting sustained private investment and creating a supportive environment aligned to boost local cashew nuts processing.

### 6.2.1 Cashew Nuts Processing Case Study 001@gh – large-scale

*Cashew Processing Case 001@gh – large-scale*, a leading cashew processing company with a modern facility in Prampram, in Greater Accra Region. While its installed capacity is 30,000 metric tons per year, current processing volumes ranges from 15,000 to 20,000 metric tons. The company focuses on enhancing the cashew industry in Ghana through strategic partnerships with local producers and overseas cashew kernel buyers. The company has experienced a drastic decline in recent years.

**Table 25: Annual throughput year 2023 & 2024 – Cashew Nuts Processing Case Study #001@gh – large-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (tons/month) | Output/intake(tons per months) | Utilization rate (%) | Month | Installed/Design capacity (Tons/month) | Output/intake (tons/month) | Utilization rate (%) |
| Jan | 3,500 | 1,850 | 52.86 | Jan | 3,500 | 1,000 | 28.57 |
| Feb | 3,500 | 2,600 | 74.29 | Feb | 3,500 | 1,950 | 55.71 |
| March | 3,500 | 2,950 | 84.29 | March | 3,500 | 2,150 | 61.43 |
| April | 3,500 | 3,050 | 87.14 | April | 3,500 | 1,850 | 52.86 |
| May | 3,500 | 3,600 | 102.86 | May | 3,500 | 2,050 | 58.57 |
| June | 3,500 | 3,750 | 107.14 | June | 3,500 | 2,250 | 64.29 |
| July | 3,500 | 3,140 | 89.71 | July | 3,500 | 2,000 | 57.14 |
| August | 3,500 | 3,050 | 87.14 | August | 3,500 | 1,900 | 54.29 |
| September | 3,500 | 3,000 | 85.71 | September | 3,500 | 2,175 | 62.14 |
| October | 3,500 | 2,980 | 85.14 | October | 3,500 | 2,050 | 58.57 |
| November | 3,500 | 2,900 | 82.86 | November | 3,500 | 1,750 | 50.00 |
| December | 3,500 | 2,250 | 64.29 | December | 3,500 | 1,650 | 47.14 |
| Total | 42,000 | 35,120 | 83.62 | Total | 42,000 | 20,600 | 49.05 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =84%

Year 2024 =49%

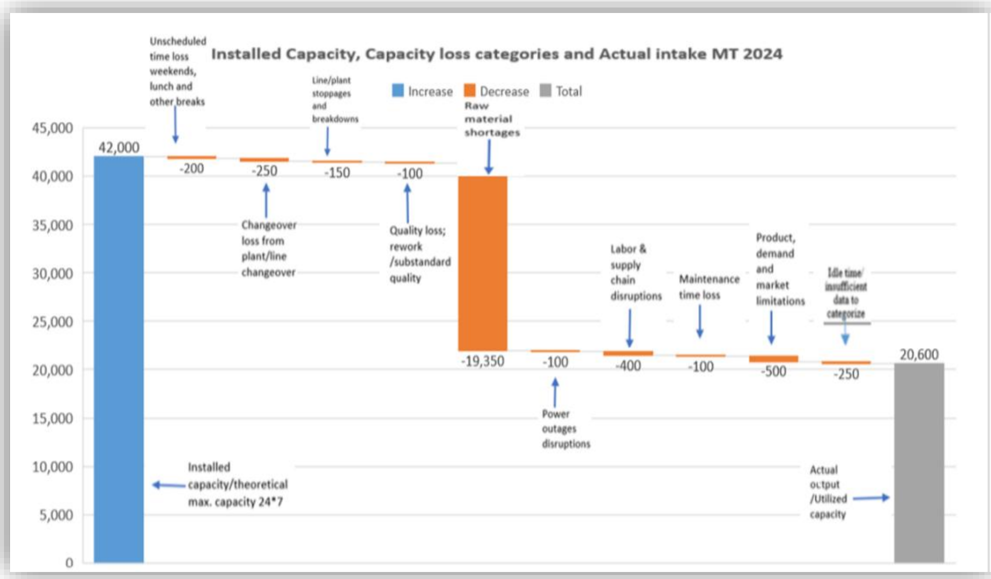



**Figure 45: Capacity utilisation and loss analysis 2024 – Cashew Nuts Processing Case Study #001@gh – large-scale**

*Overall equipment effectiveness analysis*

At *Cashew Processing Case Study 001@gh – large-scale*, quality losses were reported at 2% of productive time over 16 hours of run time, 6 days a week. From the data collected and analysed the OEE performance for the company in the Year 2024 was reported as follows:


**Figure 46: Overall equipment effectiveness analysis 2024 – Cashew Nuts Processing Case Study #001@gh – large-scale**

*Conclusive case findings*

At *Cashew Processing Case 001@gh – large-scale*, capacity utilisation currently at 49%, with Overall Equipment Effectiveness (OEE) at 72%, significantly below the desired world-class benchmark of 85%. This underperformance is largely attributed to the operation of a single 8-hour shift and declining volume of raw materials. To enhance OEE and overall capacity utilisation, raw materials availability that can support a 24/7 operational is critical.

### 6.2.2 Cashew Nuts Processing Case Study 002@gh – medium-scale

*Cashew Processing Case Study 002@gh – medium-scale* processes cashew products for both domestic and international markets. The company has strategic partnerships with well-known brands a strategic that has recently borne fruits in terms of capacity throughput.

**Table 26: Annual throughput year 2023 & 2024 – Cashew Nuts Processing Case Study #002@gh – medium-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (tons/month) | Output (tons per months) | Utilization rate (%) | Month | Installed/Design capacity (Tons/month) | Output (tons/month) | Utilization rate (%) |
| Jan | 100 | 45 | 45 | Jan | 100 | 45 | 45 |
| Feb | 100 | 60 | 60 | Feb | 100 | 90 | 90 |
| March | 100 | 65 | 65 | March | 100 | 80 | 80 |
| April | 100 | 40 | 40 | April | 100 | 75 | 75 |
| May | 100 | 30 | 30 | May | 100 | 70 | 70 |
| June | 100 | 20 | 20 | June | 100 | 60 | 60 |
| July | 100 | 10 | 10 | July | 100 | 55 | 55 |
| August | 100 | 15 | 15 | August | 100 | 45 | 45 |
| September | 100 | 5 | 5 | September | 100 | 50 | 50 |
| October | 100 | 5 | 5 | October | 100 | 45 | 45 |
| November | 100 | 7 | 7 | November | 100 | 30 | 30 |
| December | 100 | 8 | 8 | December | 100 | 20 | 20 |
| Total | 1,200 | 310 | 26 | Total | 1,200 | 615 | 51 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =26%

Year 2024 =51%

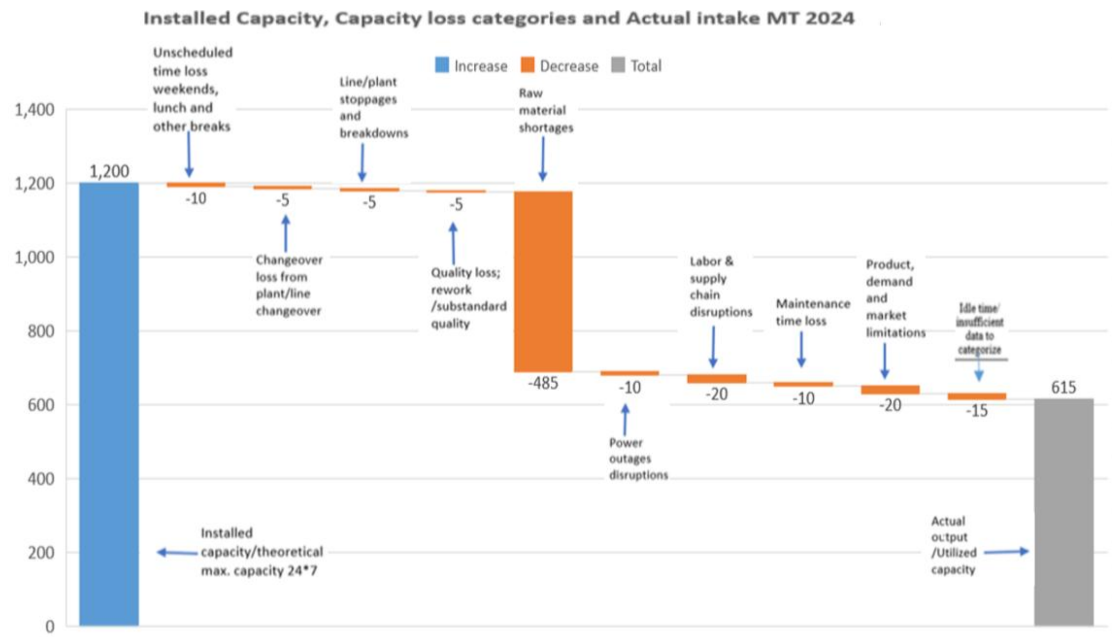



**Figure 47: Capacity utilisation and loss analysis 2024 – Cashew Nuts Processing Case Study #002@gh – medium-scale**

*Overall equipment effectiveness analysis*

At *Cashew Processing Case Study 002@gh – medium-scale*, quality losses were reported at 2% of productive time over 16 hours of run time, 6 days a week. From the data collected and analysed the OEE performance for the company in the Year 2024 was reported as follows:

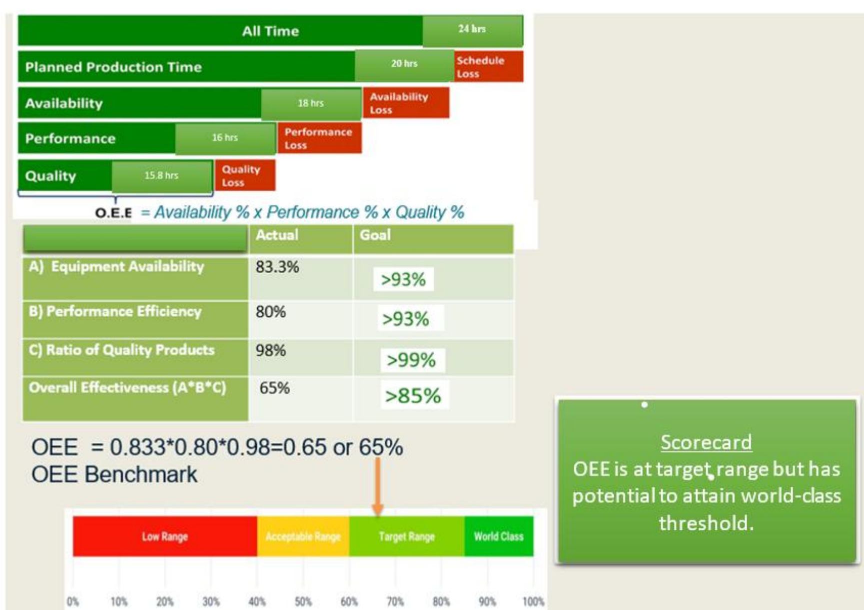



**Figure 48: Overall equipment effectiveness analysis – capacity utilisation and loss analysis 2024 – Cashew Nuts Processing Case Study #002@gh – medium-scale**

*Conclusive case findings*

At *Cashew Processing Case 002@gh – medium-scale*, capacity utilisation currently stands at 51%, a healthy improvement from 26% posted in 2023. This boon was occasioned by a strategic buyer who has invested in raw materials acquisition. Overall Equipment Effectiveness (OEE) at 65%, significantly below the desired world-class benchmark of 85%. This underperformance is largely attributed to the operation of a single 8-hour shift. To enhance OEE and overall production efficiency, the company should consider transitioning to a 24/7 operational model as access to raw materials improves.

### 6.2.3 Conclusions: Cashew processing in Ghana

Poor cashew nut processing capacity utilisation in Ghana mainly results from the lack of supportive policies and necessary processing infrastructure, leading to the export of most of its raw cashew nuts (RCN) at lower prices. This issue is worsened by challenges such as limited access to financing for processors. Implementing accelerated cashew processing policies can play a vital role in optimising processing capacity utilization. From harvesting to packaging, each step should be carefully managed to reduce quality loss.

## 6.3 Cashew processing in Nigeria

Nigeria stands as one of the world's foremost cashew producers, but its cashew industry is defined by both significant potential and persistent challenges. Despite high production volumes, the majority of cashew nuts are exported raw, mainly to Vietnam and India, because local processing capacity remains limited. This has slowed the country's ability to move up the value chain and fully realise the economic benefits of its cashew sector. Government and industry efforts – including tax incentives for processors, targeted training, and improved market access – are underway to increase local processing, create jobs, and empower farmers. Several companies, such as WACOT Limited and Valency International, are investing in processing plants, but progress is uneven, with some facilities closing due to infrastructure deficits, uncompetitive prices, and unreliable power. The sector also faces workforce skill gaps and inconsistent government policy, notably export restrictions that disrupt market stability. Nevertheless, interest in domestic processing is growing, and the industry's future holds promise, especially as more attention is paid to value-added products and by-products like cashew apple juice and cashew nut shell liquid. Overcoming capacity gap bottlenecks could transform Nigeria into a leading processor, increasing export revenues and supporting broader economic development.

### 6.3.1 Cashew Nuts Processing Case Study 001@ng – large-scale

**Table 27: Annual throughput year 2023 & 2024 – Cashew Nuts Processing Case Study #001@ng – large-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (tons/month) | Intake (tons per months) | Utilization rate (%) | Month | Installed/Design capacity (Tons/month) | intake (tons/month) | Utilization rate (%) |
| Jan | 850 | - | 0.00 | Jan | 850 | - | - |
| Feb | 850 | - | 0.00 | Feb | 850 | - | - |
| March | 850 | 325 | 38.24 | March | 850 | 340 | 40.00 |
| April | 850 | 450 | 52.94 | April | 850 | 350 | 41.18 |
| May | 850 | 280 | 32.94 | May | 850 | 320 | 37.65 |
| June | 850 | 175 | 20.59 | June | 850 | 275 | 32.35 |
| July | 850 | 190 | 22.35 | July | 850 | 290 | 34.12 |
| August | 850 | 180 | 21.18 | August | 850 | 120 | 14.12 |
| September | 850 | 150 | 17.65 | September | 850 | 100 | 11.76 |
| October | 850 | - | 0.00 | October | 850 | - | - |
| November | 850 | - | 0.00 | November | 850 | - | - |
| December | 850 | - | 0.00 | December | 850 | - | - |
| Total | 10,200 | 1,750 | 17.16 | Total | 10,200 | 1,795 | 17.60 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

Year 2023 =17%

Year 2024 =18%

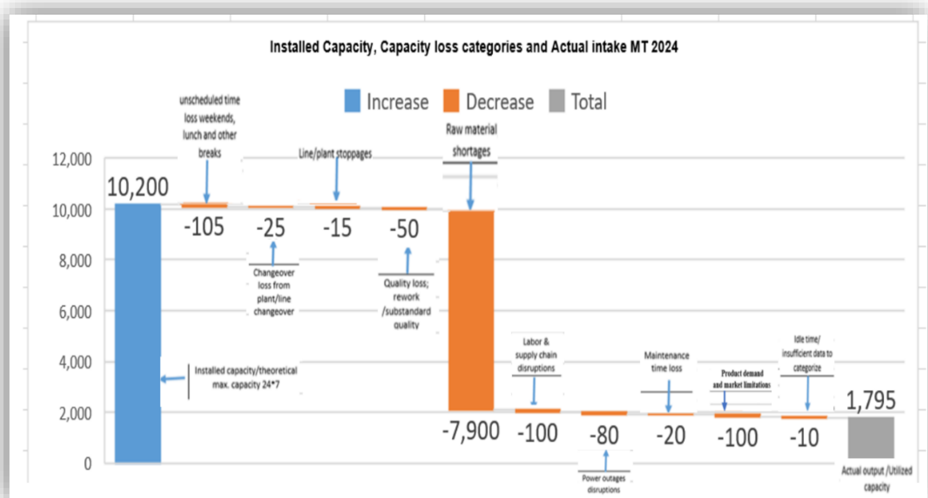



**Figure 49: Capacity utilisation and loss analysis 2024 – Cashew Nuts Processing Case Study #001@ng – large-scale**

*Overall equipment effectiveness*

At *Cashew Processing Case Study 001@ng – large-scale*, quality losses were reported at 2% of productive time over 16 hours of run time, 6 days a week. From the data collected and analysed the OEE performance for the company in the Year 2024 was reported as follows:

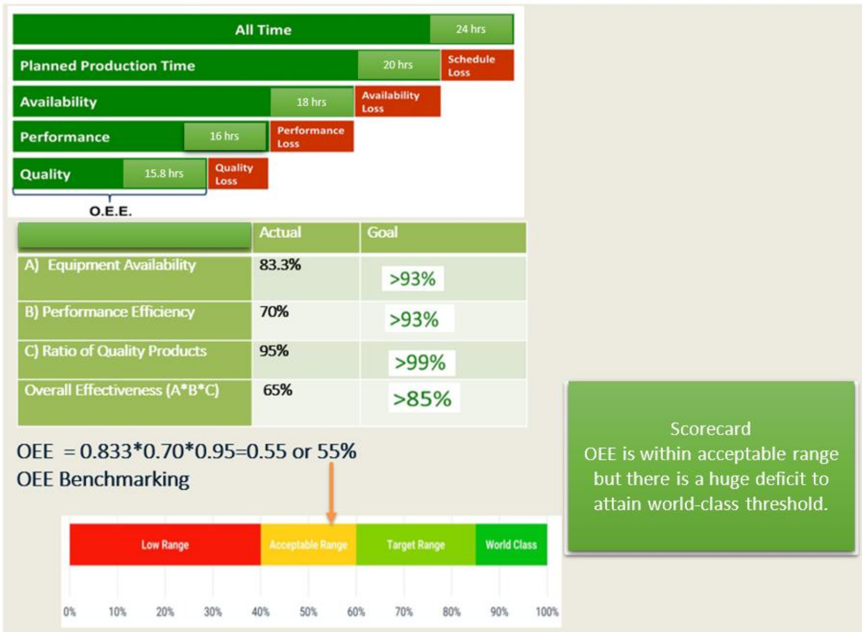



**Figure 50: Overall equipment effectiveness analysis 2024 – Cashew Nuts Processing Case Study #001@ng – large-scale**

*Conclusive case findings*

At *Cashew Nuts Processing Case Study #001@ng – large-scale*, capacity utilisation currently stands at a dismal 18%, with Overall Equipment Effectiveness (OEE) at 55%, significantly below the desired world-class benchmark of 85%. This underperformance is largely attributed to the operation of a single 8-hour shift and acute shortage of raw materials. To enhance OEE and overall capacity utilisation access to sufficient raw materials is key.

### 6.3.2 Cashew Nuts Processing Case Study 002@ng – medium-scale

*Cashew Nuts Processing Case 002@ng – medium-scale* started operations in 2021 and has an annual installed capacity of 1800Mt. The company produces Cashew Kernels of various grades which are then roasted, flavoured and packaged for domestic sales. The company also exports 30% of production to the middle east.

**Table 28: Annual throughput year 2023 & 2024 – Cashew Nuts Processing Case Study #002@ng – medium-scale**

| Year 2023 | | | | Year 2024 | | | |
|---|---|---|---|---|---|---|---|
| Month | Installed/Design capacity (tons/month) | Intake (tons per months) | Utilization rate (%) | Month | Installed/Design capacity (Tons/month) | intake (tons/month) | Utilization rate (%) |
| Jan | 150 | - | 0.00 | Jan | 150 | - | - |
| Feb | 150 | - | 0.00 | Feb | 150 | - | - |
| March | 150 | 70 | 46.67 | March | 150 | 90 | 60.00 |
| April | 150 | 75 | 50.00 | April | 150 | 100 | 66.67 |
| May | 150 | 80 | 53.33 | May | 150 | 80 | 53.33 |
| June | 150 | 75 | 50.00 | June | 150 | 75 | 50.00 |
| July | 150 | 55 | 36.67 | July | 150 | 65 | 43.33 |
| August | 150 | 50 | 33.33 | August | 150 | 60 | 40.00 |
| September | 150 | 35 | 23.33 | September | 150 | 35 | 23.33 |
| October | 150 | - | 0.00 | October | 150 | - | - |
| November | 150 | - | 0.00 | November | 150 | - | - |
| December | 150 | - | 0.00 | December | 150 | - | - |
| Total | 1,800 | 440 | 24.44 | Total | 1,800 | 505 | 28.06 |

$$\text{Capacity Utilization} = \frac{\text{Actual Level of Output}}{\text{Maximum Level of Output}} \times 100$$

| Year 2023 | Year 2024 |
|---|---|
| =24% | =28% |

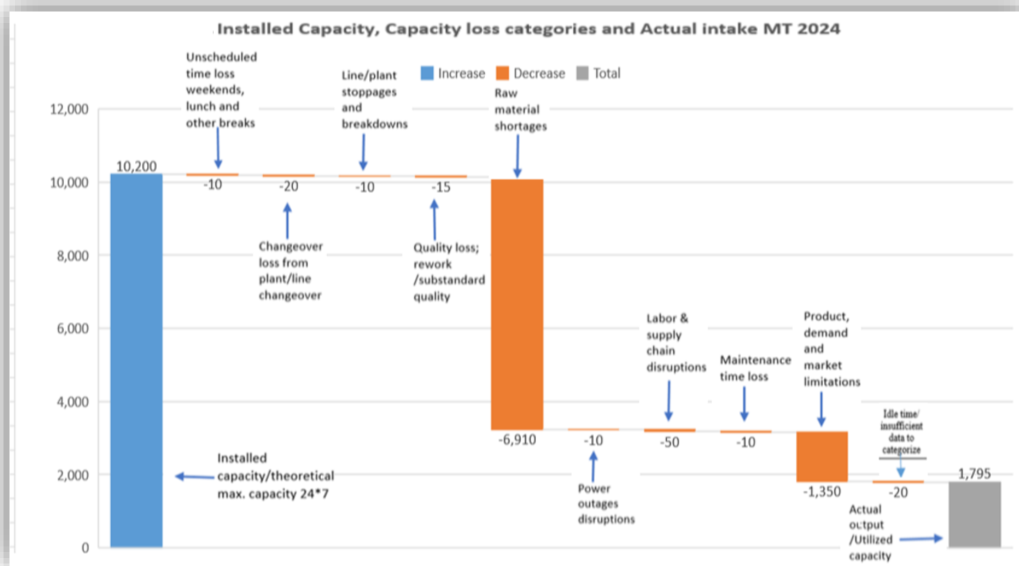



**Figure 51: Capacity utilisation and loss analysis 2024 – Cashew Nuts Processing Case Study #002@ng – medium-scale**

*Overall equipment effectiveness analysis*

At *Cashew Nuts Processing Case Study 002@ng – medium-scale*, quality losses were reported at 2% of productive time over 16 hours of run time, 6 days a week. From the data collected and analysed the OEE performance for the company in the Year 2024 was reported as follows:

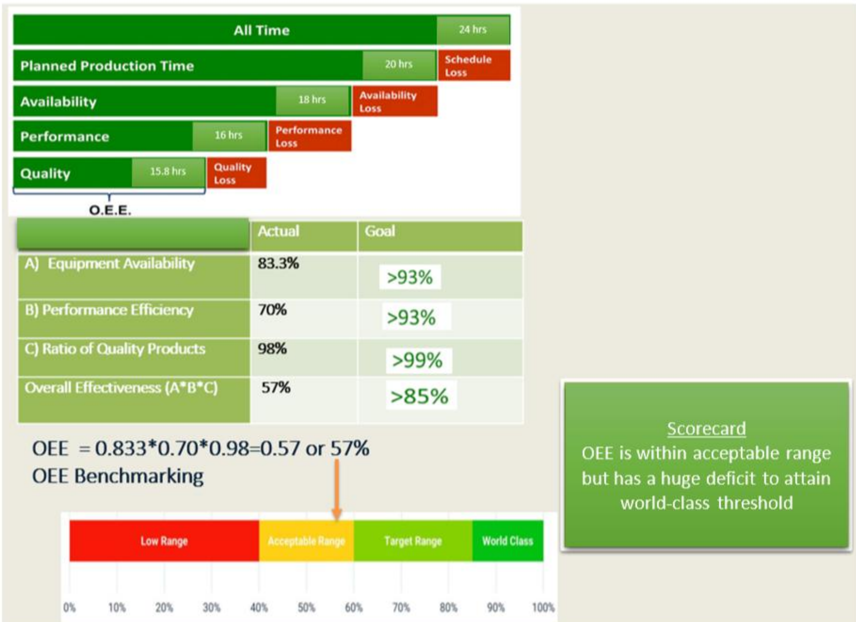



**Figure 52: Overall equipment effectiveness analysis – capacity utilisation and loss analysis 2024 – Cashew Nuts Processing Case Study #002@ng – medium-scale**

*Conclusive case findings*

Optimal mechanisation and automation in cashew nut processing present significant challenges, primarily due to the labour-intensive nature of shell cracking and quality control, as well as the health risks associated with cashew nut shell liquid (CNSL). In Nigeria, local cashew processors are grappling with a critical shortage of Raw Cashew Nuts (RCN), compounded by foreign competition and insufficient government support, leading to operational disruptions and job losses. This competition fosters an artificial scarcity that hampers efforts to improve domestic processing and value addition. For *Cashew Nuts Processing Case 002@ng – medium-scale*, current operational metrics show a capacity utilisation rate of 28% and an Overall Equipment Effectiveness (OEE) of 57%, indicating substantial potential for improvement. By tackling raw material shortages and losses in availability, performance, and quality, the company can enhance capacity and optimise efficiency, thereby increasing production effectiveness.

### 6.3.3 Conclusions: Cashew processing in Nigeria

Poor cashew nut capacity utilisation in Nigeria mainly results from the lack of supportive policies and necessary processing infrastructure, leading to the export of most of its raw cashew nuts (RCN). This issue is worsened by challenges such as limited access to finance for processors. Implementing accelerated cashew processing policies and access to finance can play a vital role in optimising processing capacity utilisation. From harvesting to packaging, each step should be carefully managed to reduce quality loss.

## 6.4 Comparative summary of cashew nuts processing firms' capacity utilisation

Both Nigeria and Ghana have low cashew nut processing capacity utilisation, with many processing units operating below 30% of their technical capacity. Both Nigeria and Ghana exports over 80% of raw cashew nuts, indicating that a large portion of the potential processing capacity is left idle. The two countries aim to increase local processing capacity and reduce raw cashew nut exports however, higher costs of RCN, transportation and energy lead to lower competitiveness for Ghanian and Nigerian processors compared to countries like Vietnam. Overall both countries are heavily involved in the export of raw cashew nuts, and cite export of RCN as the major cause of their underutilised processing sector.

**Table 29: Comparative Summary of Cashew Nuts Processing Firms' Capacity Utilisation**

| Commodity | Agro-processing firm | Country | Scale | Installed processing capacity (MT)/year | Actual capacity utilisation (MT)/year | Percentage of capacity utilisation (%)/year |
|---|---|---|---|---|---|---|
| **Cashew nuts processing** | Case Study #001@gh | Ghana | Large | 42,000 | 20,600 | 49% |
| | Case Study #002@gh | Ghana | medium | 1200 | 615 | 51% |
| | Case Study #001@ng | Nigeria | Large | 10,200 | 1,795 | 18% |
| | Case Study #002@ng | Nigeria | Medium | 1,800 | 505 | 28% |

## 6.5 Benchmarking opportunities in the cashew nut processing sector

This survey found out and analysed the challenges and opportunities in cashew nut processing within Nigeria and Ghana, two of Africa's top raw cashew nut (RCN) producers. Despite their significant production, most RCN from these countries is exported unprocessed, mainly to Vietnam and India, resulting in lost economic value from local processing activities. The study identifies a persistent gap between raw nut production and domestic processing capacities, with many facilities in Nigeria and Ghana facing declining output. Key obstacles include high costs and inconsistent availability of RCN, limited financing raw materials and equipment upgrades, and infrastructural deficiencies such as inadequate roads and unreliable electricity. These issues collectively erode processing efficiency and restrict the full economic potential of the cashew sector in both countries. The report benchmarks Côte d'Ivoire's approach, which features robust policy reforms, investment in infrastructure (agro-industrial zones, roads), supportive pricing mechanisms, and penalties for smuggling. The government of Côte d'Ivoire also champions farmer training and the adoption of Good Agricultural Practices (GAP), aiming to process 50% of its cashew production domestically by 2030. Ghana and Nigeria can learn from these strategies to boost in-country cashew processing. The findings further outlines best practices for yield optimisation, including improved tree density, better management methods, and enhanced disease control to secure sufficient raw material supply. On processing efficiency, it recommends adopting advanced technologies and sustainable practices – drawing lessons from Vietnam's leadership in cashew processing through technological innovation and government support. Adhering to international quality standards (like HACCP and ISO 9000) is highlighted as a vital benchmark for accessing premium markets. Product diversification is also encouraged, such as extracting juice from cashew apples and using nutshells for energy, to expand revenue streams. Finally, the report emphasises the importance of market access strategies, including developing buyer relationships, participating in trade fairs, and leveraging on global cashew conferences for market linkages.

In conclusion, while Nigeria and Ghana have strong production bases, their cashew industries face significant structural and operational challenges. Benchmarking successful models and adopting best practices in policy, processing, quality control, and marketing are crucial to unlocking the full potential of local cashew processing for greater economic impact.

# 7.0 Conclusion

The report highlights the challenges and opportunities in Africa's agro-processing sector, emphasizing that limited investment, poor infrastructure, and restricted access to finance have led to underutilised capacity and missed economic opportunities. Despite a growing demand for processed food driven by population growth, many firms operate far below their potential due to shortages of raw materials and limited market access. The sector's development is also hindered by inadequate post-harvest infrastructure, which results in significant losses and disrupted supply chains. Further obstacles include a lack of financing for SMEs and insufficient policy support. The report suggests that targeted government policies, improved infrastructure, better access to financing, and supplier development programs are essential to boost capacity utilisation, foster competitiveness, and unlock the sector's full economic potential.

# 8.0 Key recommendations

## 8.1 Key recommendations on beef processing

To optimise the performance of beef meat processing, it is crucial to improve animal health and genetics, enhance abattoir infrastructure, implement stringent food safety standards, and promote sustainable practices in grazing, pasture, and fodder management. Focusing on these areas will not only increase production and improve meat quality but also ensure consumer safety, ultimately leading to better capacity utilisation in beef processing facilities. Specific recommendations include:

1. **Infrastructure development:** Invest in improved roads, transportation, livestock transport vehicles, and storage facilities to minimise spoilage and ensure prompt delivery of beef to markets.
2. **Food safety and hygiene:** Enforce strict hygiene standards in abattoirs and processing plants, including inspections, to prevent contamination and zoonotic diseases, crucial for market expansion and capacity utilisation.
3. **Animal health and genetics:** Promote breeding programs that improve health, disease resistance, and growth rates by introducing quality breeds and implementing vaccination programs. This will lead to robust beef production, enhancing throughput for processors.
4. **Sustainable feed management practices:** Encourage rotational grazing and pasture management to improve land use and animal welfare. Invest in the feeds value chain from pasture fodder to feed formulation for optimal utilisation of beef processing capacities.
5. **Market access and value addition:** Develop strategies for accessing domestic and international markets, including branding and value-added processing, to boost capacity throughput. Developing affordable beef meat products for the base of the pyramid demographics has potential to advance processing and improve throughput.
6. **Technical support and training:** Provide training and extension services to farmers and processors in animal husbandry, meat processing, and quality control, critical for upgrading the beef value chain and optimising capacity.
7. **Policy and regulation:** Strengthen regulatory frameworks for meat production and processing to ensure food safety and promote fair trade, opening new markets and optimising the sector.

8. **Collaboration and coordination:** Enhance collaboration among government, research institutions, the private sector, and communities to tackle challenges effectively, optimising capacity utilisation in beef processing facilities.
9. **Hidden and idle capacity:** Identify significant technical and economic potential in beef processing; modernisation investments are needed to connect slaughterhouses and processors with suitable equipment and financial institutions.
10. **Tax incentives:** To attract investors, the government should consider zero-rating taxes on equipment and machinery essential for sector modernisation.
11. **Formalising the Sector:** Develop self-regulation mechanisms, such as a meat industry council, to address the unstructured market and support business models like franchised meat outlets, promoting modernisation and sector performance.
12. **Slaughter, processing, and fabrication services:** Expand abattoir services beyond basic slaughtering to include value-added processing capabilities like grinding, mincing, and sausage production.
13. **Promotion of feedlots:** Advocate for livestock feedlots and finishing models to enhance the supply of higher-quality animals for processors.
14. **Consumer education:** Implement consumer education initiatives to counter negative perceptions of red meat and inform producers about essential food safety measures, fostering industry confidence, sustainable demand, and optimisation.
15. **Beef processing masterclass:** A comprehensive multi-session course covering advanced butchery, meat processing, and safety protocols. Participants can learn specialised techniques for cutting beef and other meats, creating value-added products like sausages, and mastering preservation methods such as curing and smoking. The curriculum may also include equipment handling, food safety practices, and business strategies for starting or growing a meat processing business.

Implementing these strategies can enhance capacity utilisation, operational effectiveness, and profitability in the beef meat processing industry.

## 8.2 Key recommendations on maize milling

To optimise maize milling performance, it is essential to ensure a reliable and consistent supply of maize, enhance extraction rates, invest in suitable equipment, and implement effective supply chain and food safety measures. Emphasising high-quality maize, efficient milling processes, and robust market strategies will further maximise capacity throughput and fulfil consumer demand. To ensure a successful maize milling operation, several key strategies should be implemented:

1. **Secure supply chains**: Establish strong relationships with farmers and suppliers through contract farming agreements and futures contracts can ensure a consistent maize supply.
2. **Optimise extraction rates**: it is imperative to maximise profitability by achieving high extraction rates of the endosperm using appropriate maize milling equipment. This is important in a highly competitive sifted maize meal marketplace.
3. **Invest in quality equipment:** Utilising high-quality milling tools, such as roller mills, to enhance efficiency and product quality is critical for performance optimisation.
4. **Efficient supply chain management:** Developing robust systems for sourcing and storing of maize and maize products is vital to minimise spoilage and ensure timely delivery.

5. **Prioritise food safety:** Implementing HACCP principles to control potential hazards in the milling process and ensuring the safety and quality of the final products is fundamental for a competitive milling business.
6. **Diversify product offerings:** Expanding the product range to include various maize products, such as different grades of maize meal and breakfast cereals, to attract a broader market can also optimise capacity throughput.
7. **Marketing and branding:** strong brands drive capacity utilisation, and thus building a strong brand identity can effectively market products and optimise capacity throughput.
8. **Distribution network development:** Creating a reliable distribution network to ensure accessibility of maize products in both urban and rural areas is a key market outreach strategy that can spur capacity utilisation.
9. **Contract manufacturing and co-packing:** Emerging and middle-tier millers should consider outsourcing milling and packaging processes to reduce capital expenditure on processing facilities. Large millers can also use this opportunity to tap into idle capacity.
10. **Strategic agro-parks:** Leveraging agro-park developments to cluster agro-processing industries can foster innovation and efficiency through shared infrastructure and services.
11. **Maize milling masterclass:** A detailed multi-session course focused on the essential steps to transform raw maize into flour. The course could cover processes such as cleaning, conditioning, degermination, dehulling, milling, and sifting to produce various flour grades. The course can also highlight operational efficiency and the importance of operator skills in maintaining product quality and yield, food safety and hygiene, machine calibration, quality control, methods for detecting contaminants and utilisation of by-products.

Implementing these strategies can enhance capacity utilisation, operational effectiveness, and profitability in the maize milling industry.

## 8.3 Key recommendations on dairy processing

To optimise dairy processing performance, key recommendations include improving farm-level milk production and quality, enhancing milk collection and chilling infrastructure, investing in training for dairy professionals, and establishing regulatory frameworks for quality control and market information. Additionally, it is essential to address the impacts of climate change on dairy farming. Key recommendations to optimise dairy processing include;

1. **Contract manufacturing and co-packing:** This survey identifies the potential of contract manufacturing and co-packing in the dairy processing sector to increase the utilisation of existing facilities. By processing products for other brands or private labels, companies can expand their output and reach new markets without large investments in processing infrastructure.
2. **Adoption of cooperative model:** The survey explored the contribution of cooperatives to Kenya's dairy processing sector, particularly regarding their impact on smallholder farmers. Cooperatives provide essential services such as veterinary care and financial assistance, facilitate collective ownership, and encourage vertical integration. This structure enables farmers to access better market prices and make joint investments in processing facilities. Moreover, cooperatives empower members by promoting democratic participation in the supply chain and advocacy for farmer interests. The Kenyan experience demonstrates that the cooperative business model can foster sustainable growth in emerging dairy sectors.

3. **Strategic agro-parks:** Strategic agro-parks in dairy processing can enhance operational efficiency through improved infrastructure, enabling a seamless process from raw material sourcing to product packaging. By clustering agro-processing industries, these parks can promote innovation, infrastructure sharing, and economies of scale. They can specifically aid agro-processors by leveraging concentrated resources and facilitating knowledge transfer, thereby reducing logistical costs and enhancing competitiveness.
4. **Adoption of climate-resilient practices:** To address climate change within dairy farming, it is essential to support the adoption of climate-resilient practices. This can be achieved by developing drought-resistant animal breeds, promoting effective water harvesting techniques, and enhancing fodder production. Moreover, strategies must be formulated to mitigate the impacts of climate change on dairy production by equipping farmers with the necessary information and resources to adapt to evolving climatic conditions.
5. **Dairy expertise:** Investing in human capital is essential for the sustainability of the dairy industry. This includes training dairy scientists, technologists, and food engineers to cultivate local expertise. Additionally, providing business management training will empower farmers and processors to manage their operations effectively and access markets. Furthermore, developing sector-specific skills through technical and vocational education and training (TVET) programs is vital to addressing the skills gaps within the dairy and agro-processing sectors.
6. **Regulatory framework:** To establish effective regulatory frameworks in the dairy sector, it is essential to implement quality control measures that set standards for milk and dairy products, alongside systems for testing and certification. Providing access to market information enables farmers to make informed decisions regarding production and pricing. Additionally, enforcing regulations is crucial to ensure compliance with quality standards, thereby protecting consumer interests.
7. **Cold-chain investment:** Investing in milk collection and chilling infrastructure is essential throughout the value chain to ensure quality during transportation and storage. Establishing milk collection and chilling centres is crucial for maintaining the quality of raw milk by rapidly cooling it after milking, thereby reducing bacterial growth and spoilage.
8. **Last-mile extension services:** Improving milk production and quality at the farm level involves several key strategies. Enhancing animal health and feeding through the provision of quality feed, access to veterinary services, and good management practices, such as zero-grazing, can lead to significant increases in both yield and quality. Additionally, training programs and extension services play a crucial role in educating farmers on best practices related to milk production, animal health, and hygiene.
9. **Dairy processing masterclass:** A comprehensive multi-session program focused on the entire dairy production process, from milk reception and quality control to the creation of products like yogurt, cheese, and butter. The program can combine theoretical instruction with practical, hands-on experience, covering key topics such as milk handling, processing technologies, product manufacturing, quality assurance, equipment management, business fundamentals, marketing, and sustainable practices, equipping participants with essential skills for both technical operations and business success in the dairy industry.

## 8.4 Key recommendations on cashew processing

To optimise the performance of cashew processing in Africa and enhance capacity utilisation, key recommendations include increasing local processing capacity and enhancing technical skills through targeted training. Ensuring a reliable supply of high-quality raw materials and improving market access are essential, as is strengthening government support through tailored policy frameworks. Furthermore, promoting the development of cashew byproducts, fostering cooperation among cashew-growing regions, and improving rural infrastructure are vital components of this strategy.

1. **Contract manufacturing and co-packing:** This survey examined the advantages of contract manufacturing and co-packing for companies in the cashew nuts processing sector, especially those without their own production lines. The findings show that outsourcing production helps these companies enter the market with lower capital investment and reduced overhead costs. By working with packers and private label brands, cashew agro-processors can use existing production infrastructure, improve operational efficiency, and gain better market access – benefits that are particularly important for small and medium enterprises (SMEs). Additionally, the ability to scale production based on market demands and to focus on core strengths can lead to higher competitiveness and cost savings within the industry.
2. **Strategic agro-parks:** The strategic development of agro-parks can facilitate the clustering of cashew processing industries, promoting innovation and shared infrastructure while enhancing ecosystem services and creating economies of scale. By positioning processing facilities closer to farm-gate collection points, agro-parks effectively shorten supply chains, reduce dependence on raw product exports, and ensure that value addition and profits remain within the local community, thereby stimulating demand for processed goods.
3. **Infrastructure upgrading:** In order to enhance agricultural productivity, it is crucial to upgrade rural infrastructure, specifically secondary roads, which will aid in connecting farms to processing centres and facilitate the transportation of goods. Additionally, substantial investments in storage facilities are crucial for mitigating post-harvest losses and maintaining a consistent supply of agricultural products.
4. **Regional cooperation:** Fostering regional collaboration between cashew-producing nations can improve access to RCN, market stability, reduce supply bottlenecks, and smoothen cross-border RCN trade to support cashew processors across the region.
5. **Policy alignment to support local cashew processing:** West African countries currently process less than 15% of their cashew production, with the majority exported raw and subsequently processed in Asia, primarily in India and Vietnam. To promote local cashew processing, policies must address the entire value chain by enhancing farmer access to technology and finance, improving infrastructure, offering incentives for local processors, and encouraging regional cooperation. Essential actions include providing subsidies and tax breaks for processing initiatives, enhancing rural infrastructure, strengthening cooperatives for farmer-processor connections, implementing minimum producer prices, and harmonising regulations at both national and regional levels.
6. **Cashew processing masterclass:** A comprehensive, multi-session program focused on cashew value chain training, covering a wide range of topics including production, processing, market dynamics, financing, equipment management, quality standards, and negotiation skills, as well as international grading standards. The curriculum can combine classroom instruction with practical exercises and fieldwork to ensure participants gain hands-on experience, equipping individuals with the skills to evaluate and manage cashew nut quality throughout the entire production and processing cycle.

# 9.0 Cross-cutting ecosystem improvement recommendations

## Supply chain and infrastructure ecosystem

The agro-processing supply chain ecosystem comprises farmers, transporters, warehouses, processors, and retailers, supported by key infrastructure such as transportation networks, storage facilities, and processing plants. This system relies on the flow of materials and information, supported by logistics, technology (such as ICT), and practices like sustainable sourcing and circular economy principles, to promote efficiency, resilience, and market competitiveness. Key intervention areas include;

- **Contract farming:** Contract farming arrangements establish clear agreements between farmers and processors, reducing risks associated with changes in production and quality. This enables processors to plan more effectively and manage resources more efficiently. By ensuring a steady supply of high-quality raw materials, these contracts support the smooth operation of processing facilities and help maintain stable prices.
- **Farmer capacity building:** Improving farmers' skills and resource access through training leads to better farm management, allowing farmers to produce enough and higher-quality products. This increases processing capacity use and efficiency.
- **Demand forecasting:** Improved demand forecasting helps agro-processors align production with market needs, decreasing overproduction and waste. This improves storage and processing, leading to higher overall capacity utilisation in agro-processing. Efficient resource allocation involves optimising the flow of raw materials, labour, and equipment to maximise efficiency and eliminate bottlenecks. A precise demand forecast can enhance the management of transportation routes, storage facilities, and production schedules. Streamlining logistics and processes enables agro-processors to respond swiftly to market demands, increasing capacity utilisation.
- **Enhanced collaboration:** Better coordination among stakeholders, including farmers, processors, and distributors, improves operational efficiency and optimises materials and information flow.
- **Inventory optimisation:** Effective inventory management ensures timely resource availability, prevents production delays, and promotes better capacity utilisation.
- **Flexible workforce:** Implementing a flexible workforce allows agro-processing businesses to adjust staffing to meet production demands. This approach minimises downtime, optimises resources, and enhances efficiency and profitability, particularly by utilising temporary or seasonal workers during peak periods.
- **Infrastructure Improvements:** Upgrading infrastructure – such as roads, energy systems, and water management – reduces post-harvest losses and transportation costs while facilitating access to larger markets, thereby improving processing efficiency and capacity through facilities like silos and cold-chain systems.
- **Traceability and transparency:** Establishing detailed tracking systems for agricultural products throughout the supply chain promotes better resource management and minimises waste, resulting in more efficient production processes and increased capacity utilisation in agro-processing facilities.

- **Backward integration:** Engaging in backward integration through direct investment in farms or contract farming enhances control over raw material quality and availability, allowing consistent use of processing capacity.

## Collaboration and partnerships ecosystem

The agro-processing collaboration and partnership ecosystem is a network of diverse stakeholders – including farmers, processors, researchers, governments, NGOs, and consumers – who work together to improve agricultural value chains. This ecosystem is built on shared interests and trust to overcome challenges like food insecurity and climate change, leading to innovations, increased efficiency, and more resilient food systems. Key activities include joint planning, information sharing, and harmonising subsector initiatives to avoid duplicated efforts and maximise benefits. Key interventions include;

- **Public-private partnerships:** PPPs enhance agro-processing through the collaboration of public resources and private innovation, addressing sector challenges to improve efficiency and sustainability; outsourcing and contract manufacturing can boost capacity utilisation.
- **Strategic partnerships:** Establishing stronger linkages with buyers, financial institutions and partnerships with larger distributors and retailers can provide necessary resources and stabilise demand for processed goods under sustainable business terms.
- **Capacity building:** Targeted training on agro-processing techniques, quality control, and maintenance enhances worker skills, leading to improved operations; it supports the adoption of new technologies and streamlines resource management through education in inventory and supply chain optimisation.
- **Supply chain coordination:** Poor coordination among producers, processors, and traders leads to delays and inefficiencies in acquiring raw materials. Building partnerships among agro-processors, farmers, and stakeholders, along with creating aggregation centres, can boost agro-processing activities and enhance the marketability and value of agricultural products. Promoting farmer-producer organisations (FPOs) and developing digital platforms to connect farmers with agro-processors can improve market access, reduce dependence on intermediaries, and increase produce off-take.
- **Investment in agro-parks and special manufacturing zones:** Focus on regional resource mapping to ascertain raw material nodes and availability that can sustainably support agro-processing competitiveness and locate agro-processing facilities at raw material hubs.

## Market ecosystem

A market ecosystem in agro-processing is a network of interconnected actors and factors that convert raw agricultural products into value-added goods, including farmers, processors, input suppliers, technology providers, and consumers. Key components include the physical movement and transformation of goods, ownership transfers, and supporting functions such as marketing, finance, and market intelligence. The ecosystem's health relies on its ability to innovate, overcome challenges such as supply chain disruptions, and utilise technologies to improve efficiency and competitiveness. Key intervention areas include;

- **Market linkages:** Facilitating market linkages is crucial for enhancing agro-processing capacity by ensuring a steady supply of agricultural produce, access to market information, and minimising post-harvest losses.

- **Product diversification:** Expanding product range enhances efficiency and profitability, enables year-round operations, and reduces risks linked to seasonal fluctuations and market volatility.
- **Market development:** These initiatives can improve capacity utilisation by creating demand for processed products through new market identification, enhanced access, and improved value propositions. Exploring new markets can enhance agro-processing capacity utilisation by introducing new products, targeting diverse customer segments, and leveraging digital technologies.
- **Product distribution and market outreach:** Strengthening distribution channels ensures efficient movement of raw materials to processing facilities and final products to consumers, aided by improved infrastructure and streamlined logistics.
- **Market information systems:** Market information systems supply essential data on prices, demand, and supply, aiding farmers and processors in decision-making and optimising production and distribution. Enhanced information pathways between farmers and processors, supported by producer groups and aggregators, ensure a steady supply of high-quality raw materials for processing.

## Financing ecosystem

The components of a financing ecosystem in agro-processing include various financing models and institutions that provide capital, support risk management, and facilitate financial access. Key components are debt capital, provided by financial intermediaries; equity capital, which involves selling ownership stakes; and guarantee schemes, which reduce the risk for lenders. These components are supported by specific financing models like warehouse receipt, wholesale, and agricultural mechanisation financing, as well as new models focused on climate resilience, financial inclusion, and fintech. Plausible interventions include:

- **Access to competitive credit:** Access to finance and working capital is essential for agro-processors to enhance operations, capacity utilisation, and overall productivity, allowing investment in modern equipment, infrastructure, and efficient technologies.
- **Targeted finance:** Syndicated and targeted lending programs can address the specific needs of agro-processors, offering tailored financial solutions that consider cash flow patterns and seasonal demands, thereby fostering greater capacity utilisation.
- **Credit guarantee schemes (CGSs):** Credit guarantee schemes (CGSs) can enhance capacity utilisation in agro-processing by reducing the risk for financial institutions lending to small and medium enterprises (SMEs), facilitating access to finance for investments in technology and operational expansion.
- **Financial management skills:** Enhancing capacity utilisation in agro-processing through effective financial management optimises resource allocation, controls costs, and supports informed decision-making, resulting in improved operational efficiency and increased production output.
- **Value chain financing:** Focusing on financing throughout the entire agricultural value chain – from input suppliers to processors and retailers – ensures a smooth flow of goods and capital. This ecosystem financing supports investments in modern processing equipment, storage, and transportation, enabling agro-processors to handle larger volumes of raw materials and outputs. Access to finance secures a steady supply of high-quality raw materials, preventing production

disruptions and maximising processing capacity. It also promotes efficient processing techniques, effective inventory management, and rigorous quality control, ultimately reducing production costs and enhancing competitiveness throughout the value chain.

## Agro-manufacturing and processing ecosystem

The components of an agro-manufacturing and processing ecosystem can be broadly categorised into production/supply, processing/infrastructure, and market/demand. Production relies on raw material supply from factors like land, labour, and capital, and includes components like crop and livestock production. Processing is supported by infrastructure, including processing facilities and logistics, while the market is driven by both domestic and external demand for agro-processed products. Key intervention areas include;

- **Training on lean manufacturing practices:** Training agro-processors on lean manufacturing practices can lead to improved efficiency, reduced waste, and better capacity utilisation through principles like continuous improvement and process optimisation.
- **Value chain-specific agro-processing toolkits:** Developing value chain-specific agro-processing toolkits can guide agro-processors in optimising each stage of a product's journey, with a focus on productivity and sustainability.
- **Performance measurement:** Training agro-processors on Overall Equipment Effectiveness (OEE), capacity utilisation, and world-class benchmarking will enable them to evaluate the efficiency of processing activities effectively.
- **Technology optimisation:** Technology plays a crucial role in enhancing agro-processing capacity utilisation by optimising operations, reducing waste, and improving efficiency through digital tools, automation, and data analytics. The use of mobile applications and online platforms facilitates connections between buyers and sellers, provides market insights, and streamlines transactions, collectively enhancing capacity utilisation. Implementing streamlined processes and optimised workflows contributes to increased productivity and resource management, aided by tools such as value stream mapping (VSM) and dashboards for visualising and refining operations.
- **Adoption of 24/7 production:** Identifying and addressing idle dusk-time capacities in manufacturing presents an opportunity to boost profitability by optimising production schedules, improving workforce flexibility, and considering automation to extend hours of operation.
- **Agro-processing masterclasses:** An agro-processing masterclass is a specialised training program designed to impart comprehensive practical knowledge and skills for the conversion of raw agricultural products into profitable, value-added goods. Participants learn various essential topics, including food science, hygiene, preservation techniques, branding, and market access. This training aims to empower individuals to mitigate post-harvest losses, enhance product quality, and establish successful agro-processing ventures. Key areas of focus may encompass the principles of agro-processing, processing techniques, food safety and compliance, branding and marketing strategies, supply chain management, and business development.
- **Addressing bottlenecks and downtime:** Anticipating potential bottlenecks and implementing strategies such as maintenance scheduling and optimised workflows minimises production disruptions, leading to enhanced operational efficiency and capacity utilisation. Implementing process mapping enables the visualisation of workflows, allowing for the identification of

bottlenecks and inefficiencies. This analysis enables optimised operations that can handle increased output, resulting in enhanced capacity utilisation. By addressing constraints through bottleneck analysis, companies can improve overall efficiency and resource utilisation.

- **Outsourcing:** Outsourcing non-core activities allows agro-processing businesses to enhance internal resource optimisation and focus on core competencies, providing increased production output and scalability to address market demands efficiently.
- **Preventive and scheduled maintenance:** Proactive maintenance practices reduce equipment-related downtime and enhance operational efficiency. Strategic scheduling of maintenance during non-critical periods helps to minimise production disruptions and optimise operational time.
- **Data capture analysis and reporting:** There is a pressing need to establish a robust data collection system amongst medium and large-scale agro-processors to monitor key performance indicators and identify improvement trends. Currently, the use of dedicated capacity utilisation software remains limited, with many relying on general systems for production planning and inventory management.
- **Blockchain technology:** Blockchain technology enhances capacity utilisation in agro-processing through improved supply chain transparency, traceability, and efficiency. This can optimise production, storage, and distribution by tracking products from farm to consumer, minimising bottlenecks, and maximising resource use. Smart contracts automate transactions, reducing the need for intermediaries and accelerating processing times, which results in lower transaction costs and improved logistics efficiency. Ultimately, blockchain fosters enhanced efficiency, transparency, and trust throughout the supply chain.
- **Sustainable practices:** Encourage agro-forestry practices, regenerative agriculture, the use of cashew shells for heating, wastewater treatment, and align agro-processing with circular economy practices.

## Policy ecosystem

The survey report emphasises the importance of a robust policy framework in driving sustainability in the agro-processing sector. Key findings highlight the need for policies that strike a balance between economic growth, environmental responsibility, and social inclusion across the entire value chain. Key policy ecosystem interventions include:

1. **Infrastructure and logistics:**
    - **Rural roads:** Governments must invest in better rural roads to connect farms with processing sites, reducing supply bottlenecks.
    - **Processing facilities:** Governments should provide incentives for the development of modern processing units.
    - **Digital infrastructure:** Policies should promote digital solutions to improve market access and information flow within the agro-processing sector.
2. **Financial access and incentives:**
    - **Credit & Investment:** Implement credit strategies, low-interest loans, and catalyst funds to supply processors with working capital and encourage investment.
    - **Tax Incentives:** Offer tax holidays and other financial instruments to support the establishment and expansion of processing businesses.

- **Guarantee Funds:** Develop guarantees to de-risk investments in the agro-processing sector, encouraging banks and impact funds to support processors.

3. **Technical and managerial capacity:**
    - **Skill development:** Offer training TVET programs to stimulate agro-processing activities.
    - **Quality standards:** Support processors in meeting international quality standards for cashew kernels.
    - **Research and innovation:** Fund public research to identify and disseminate effective agricultural practices and processing technologies suited to local conditions.
4. **Market development and information:**
    - **Market access:** Facilitate market entry through better access to market information for processors to connect with profitable markets.
    - **Marketing strategies:** Develop robust marketing strategies that highlight the quality, environmental, and socioeconomic benefits of African processed cashews to socially conscious consumers.
    - **Support farmer cooperatives:** Policies that strengthen farmer organisations and cooperatives improve their bargaining power and access to both input and output markets, as well as create agro-processing hubs.
    - **Agro-processing diversification:** Promote the development of versatile spectrum of byproducts, such as cashew apple-based beverages and energy bricks from nut shells, to reduce waste and create new revenue streams.
5. **Regional cooperation under the African Continental Free Trade Area (AfCFTA)**
    - **Regional value chain platforms:** Establish regional value chain platforms for knowledge sharing, best practice dissemination, and coordinated industry development across African nations.
    - **Continental and national frameworks:** Policies should align with initiatives like the African Union's Comprehensive African Agricultural Development Programme (CAADP) to drive public investment and economic growth through agriculture.

In a nutshell, optimising an agro-processing ecosystem requires a holistic approach that integrates various stakeholders to improve supply chains, enhance raw material quality, and promote sustainable manufacturing practices.

# 10.0 References


https://ciccashew.org/en/cote-divoire-2/

https://www.cbi.eu/news/cote-divoire-leading-example-processing-cashew-nuts

Mbelle A.V.Y (2005), Productivity Performance in Developing Countries: Country case studies Tanzania.

Government of Kenya (2013). Kenya Vision 2030 progress report, accessed from http://www.vision2030.go.ke/cms/vds/Vision_2030-_ score_booklet.pdf on 25 July 2013.

Government of Kenya (2010). Kenya national industrialization policy frame work: ministry of Industrialization. Nairobi: Government Printer. Government of Kenya (2007).

https://gfmdhaka.com/news/why-you-should-invest-in-a-maize-milling-machine

https://millingandgrain.com/joy-millers-a-success-story-in-rural-east-africa/

The Kenya vision 2030. Nairobi: Government Printer.

https://www.africa-milk.org/study-sites

https://www.technoserve.org/fight-poverty/projects/east-africa-dairy-development/

https://www.technoserve.org/fight-poverty/projects/prosper-cashew-project/

https://www.africanexponent.com/top-10-cashew-producers-in-africa-2025/

https://www.cbi.eu/market-information/processed-fruit-vegetables-edible-nuts/vca-west-africa-cashew-2018

https://africaforinvestors.com/opportunities/cashew

https://www.roff.co.za/blogs/blog/maize-milling-business-viability?srsltid=AfmBOoqrGfPqIHWYNITrPlvqKEQytfMMLeTLmXb1QcTJq_KyxPqInzqb

http://millingmea.com/category/maize/

https://pmc.ncbi.nlm.nih.gov/articles/PMC11018704/

https://www.beefmagazine.com/


# Annex 1: Benchmarking study: Promoting and accelerating in-country cashew processing through policy in Cote d'Ivoire

This benchmarking opportunity report highlights Côte d'Ivoire's remarkable growth in the cashew industry, emphasising its rise as the world's top cashew producer and a benchmark for industry development. Between 2013 and 2021, national cashew output more than doubled, and domestic processing capacity increased fivefold. Côte d'Ivoire increased its output from 460,000 tons in 2013 to 1.1 million tons in 2021, while domestic processing capacity rose from 68,515 tons in 2015 to 350,000 tons in 2024. Government initiatives – including tax incentives, subsidies, and the creation of agro-industrial zones – are designed to boost domestic value addition and attract investment. The government's policy prioritises domestic value addition through tax incentives, subsidies, and the creation of agro-industrial zones to attract investment, complemented by capacity building and infrastructure development in partnership with the Cotton and Cashew Council (CCA) and initiatives such as Prosper Cashew. The overarching goal is to increase in-country processing from under 10% to over 50% by 2030, thereby enhancing employment and retaining greater economic value within Côte d'Ivoire.

Of all raw cashews traded in the international market, 90% are from Africa. Still, African countries process less than 15% of the nuts.

Of all raw cashews traded in the international market, 90% are from Africa. Still, African countries process less than 15% of the nuts.

The Ivorian Government has established a strong institutional and regulatory framework to improve governance, profitability, and remuneration in the cotton and cashew sectors. Key measures include the passage of Law No. 2013-656, the creation of the Cotton and Cashew Council, and the implementation of sector reforms focused on production, marketing, and processing. The Council regulates approximately 1,200 buyers, 15,000 trackers, 150 exporters, and over 30 processing units, all of which must be approved annually. To maintain sector integrity, the Council enforces traceability, price monitoring, and stakeholder training. By 2023, Côte d'Ivoire operated 46 processing units with a total cashew nut processing capacity of 300,000 tons, utilising 75% of this capacity. This performance has made the country the world's third-largest cashew processor. In 2023, Côte d'Ivoire exported nearly 720,000 tons of raw cashew nuts, with farm gate prices averaging 353 CFA francs/kg and FOB prices at 640 CFA francs/kg. Export taxes provide additional revenue for reinvestment. Ongoing initiatives focus on increasing local value addition, raising quality standards, and expanding processing capabilities to further strengthen Côte d'Ivoire's position in the global cashew market.

## Sector organisation

Key benchmarking areas focuses on the regulatory and organisational structure of Côte d'Ivoire's cashew sector. The Cotton and Cashew Council is identified as the primary regulatory authority, overseeing the development and monitoring of the sector. In September 2013, legislation established an interprofessional organisation to represent industry stakeholders. This management body was formed through a detailed process, culminating in a General Assembly in December 2022, and was formally recognised by government decree later that month. Key members of this organisation include producer federations, exporter associations, industrial groups, processing companies, and equipment manufacturers, collectively working to support and advance the cashew industry in Côte d'Ivoire.

## Key policy initiatives and measures

To promote the cashew sector sustainably, Côte d'Ivoire has taken several steps focused on adding value through local processing of cashew nuts and apples. These measures include:

- **Security deposit:** A security deposit mechanism allowing processors to mobilise financing from banks for the acquisition of raw materials;
- **Performance agreements:** The signing of agreements between the State and processing units to stabilise over time the benefit of incentive measures complementary to the investment code, with, in return, performance commitments by the processing factories.
- **Agro-industrial zones:** the development of four Agro-industrial Zones (ZAI) dedicated to the development of local cashew processing within the framework of the Project for Promoting the Competitiveness of the Cashew Value Chain, implemented by the Cotton and Cashew Council;
- **Yamoussoukro Cashew Innovation and Technology Center:** The operationalisation of the Yamoussoukro Cashew Innovation and Technology Center (CITA), a school factory dedicated to technical assistance and capacity building, as well as technology testing.
- **Promotion of Ivorian cashew trade:** The government embarked on promoting investments in Côte d'Ivoire and supporting the development of the Ivorian cashew nut trade.
- **Funding:** the government spearheads value chain funding through the Cotton and Cashew Council to support certification according to the standards of the American Food Safety Modernization Act (FSMA), as well as the consideration of Corporate Social Responsibility issues by processing units. There is also robust coordination and financing of research activities through the National Agricultural Research Programme (PNRA).
- **Extension services:** The government oversees implementation of agricultural advice dedicated to cashew nuts, with the recruitment, training, and deployment of 274 supervisory agents from the National Rural Development Agency (ANADER)
- **SIETTA:** The initiation, in 2014, of the International Exhibition of Cashew Processing Equipment and Technologies (SIETTA) for the promotion of cashew is an international event that brings the world of cashew to Côte d'Ivoire.
- **Tax incentives**: The government provides tax exemptions and holidays to processors for a period of five years on purchases of equipment and spare parts, as well as tax credits for modernising existing facilities. To further support the industry, processors are also exempt from paying import taxes on equipment and export taxes on processed cashews.
- **Infrastructure development**: This includes building and rehabilitating roads to improve access to markets and investing in storage and processing infrastructure.
- **Financial support**: Mechanisms are in place to allow manufacturers to get financing for raw material acquisition and provide access to risk management instruments for investment capital.
- **Public-private partnerships**: The government works with private companies and international organisations to implement its cashew strategy, drawing on expertise and funding from entities like TechnoServe, the World Bank, and the International Finance Corporation.

## Lessons learned

Côte d'Ivoire has emerged as a leading force in the cashew industry by implementing comprehensive policies that promote sector growth. The country's framework includes setting producer prices, taxing raw exports, and encouraging local factory development. These efforts have strengthened the domestic cashew processing sector and influenced neighbouring countries, such as Burkina Faso, Benin, and Ghana, to implement similar strategies. By targeting challenges throughout the value chain, Côte d'Ivoire's approach has improved production and commercialisation, establishing a model for agricultural development. Current and future investments, such as by-product management and agro-industrial zones, are poised to boost local cashew processing, employment, and ensure the long-term sustainability of the industry.

# Annex 2: Benchmarking study: Beef processing competitiveness and cost-efficiency in Brazil

Brazil's beef processing industry is highly competitive and efficient, thanks to its large cattle herd, modern technology, favourable climate, and abundant resources. The sector is a global leader in beef exports, especially to China and Hong Kong, and significantly contributes to the national economy. While Brazil excels in areas like scale and production efficiency, the industry faces challenges with sustainability, particularly deforestation and greenhouse gas emissions in the Amazon. Major companies like JBS, Minerva, and Marfrig, alongside many smaller ranchers, are increasingly focused on sustainable practices. Ongoing efforts aim to address environmental concerns, improve resource efficiency, and maintain Brazil's global competitiveness in beef production.

## Key benchmarks

1. **Metrics and performance**
   - **Cost of production:** Brazilian beef can be produced at significantly lower costs than in the EU, with total production costs per 100 kg of carcass weight ranging from €239 on large farms to €628 on smaller ones in 2021.
   - **Global market share:** Brazil is the world's leading beef exporter and second-largest producer, holding a significant portion of the global market.
   - **Production efficiency:** The sector has achieved higher productivity through capital-intensive, "land-saving" technologies and adapted production systems.
2. **Factors driving competitiveness**
   - **Favourable climate and land:** Brazil's extensive land availability and suitable climate facilitate large-scale cattle farming. The availability of cheap land has been a favourable factor for expanding livestock production, though this is now facing pressure from other land uses.
   - **Technological innovation:** Investments in technology have modernised production and processing, improving quality and competitiveness.
   - **Domestic market:** While exports are substantial, the majority (80%) of Brazilian beef production is consumed within Brazil, driven by increased middle-class consumption.
   - **Strategic market focus:** Strong demand, particularly from China following the African swine fever outbreak, has significantly influenced production and trade patterns, leading to a more sophisticated global trade approach.
   - **Low production costs:** Brazil's beef sector benefits from significantly lower production costs compared to European competitors, particularly on large-scale farms, according to Making Agricultural Trade Sustainable[2].
   - **Favourable policies and demand:** Government support and rising global beef demand have fuelled significant growth in the sector.

[2] https://sustainable-agri-trade.eu/brazil-the-evolution-of-cattle-farming-and-the-sustainability-challenge/

- **Technological adoption:** Implementing technologies like artificial insemination, improved forage management, and feed supplementation significantly increases cattle productivity and shortens the production cycle.
- **Value-added processing:** Developing more value-added cuts and pursuing meat origin certifications allows processors to capture a greater share of the final product's value.
- **Supply chain coordination:** Improving coordination across the beef supply chain – from production to processing and distribution – is essential for a unified, effective response to changing market demands.
- **Genetic improvement:** Using breeds like the Nellore, which are well-suited for the Brazilian environment, is a major strength of the sector.
- **Affordability:** Brazil's beef market benefits from cultural integration and lower relative costs compared to other global markets, which helps maintain demand.

3. **Cost-efficiency opportunities**
   - **Energy efficiency:** Significant potential exists to reduce energy costs in abattoirs through improved thermal energy systems and refrigeration.
   - **Supply chain integration:** A centralised supply chain approach incorporating stochastic programming can balance financial and environmental goals.
   - **Multifunctional production systems:** Silvopastoral systems and integrated crop-livestock-forestry systems can generate long-term profits and capture carbon, providing an alternative to traditional beef production.
   - **Data and analysis:** Benchmarking reports, like those from Agri-benchmark Beef, offer detailed cost comparisons and highlight best practices for resource use and management[3].
4. **Sustainability challenges**
   - **Environmental impact:** Deforestation, greenhouse gas (GHG) emissions, and land degradation are major concerns for the beef sector.
   - **Feedlots and deforestation:** Cattle are often fattened in feedlots using corn and soy, a practice that greatly contributes to deforestation and greenhouse gas emissions.
   - **Resource use:** Optimising resource efficiency in abattoirs, particularly reducing electrical and thermal energy consumption, is crucial, according to the World Bank. Studies on processing facilities indicate potential for significant energy savings (32% for thermal energy, 12% for electricity) by implementing efficiency measures[4].

## Lessons learned

This report notes the strategies behind Brazil's beef processing competitiveness and cost-effectiveness. The main findings emphasise the importance of adopting technological advances such as artificial insemination and improved pasture management to increase productivity and reduce production cycles. Despite Brazil's strong export market, domestic consumption – driven by a growing middle class – accounts for the majority of beef consumption. Adding value through specialised cuts and certifications, alongside improved supply chain coordination, can help maximise processor profits and market responsiveness. Challenges persist, including high production costs and unequal access to technology,

[3] http://www.agribenchmark.org/beef-and-sheep.html

[4] https://documents1.worldbank.org/curated/en/617721613718034647/pdf/Benchmarking-Study-Resource-Efficiency-in-Red-Meat-Abattoirs-in-South-Africa.pdf

making education and incentives crucial for the broader adoption of sustainable and efficient practices. Ultimately, a more integrated approach to production, processing, and distribution, along with a focus on economic efficiency, will strengthen Brazil's position in the global beef industry.

# Annex 3: Benchmarking study: Successful dairy processing cooperatives in Kenya – Case of Githunguri Dairy Farmers Co-operative Society Ltd.

Githunguri Dairy Farmers Co-operative Society Ltd is recognised as a leading dairy cooperative in Kenya, celebrated for its unity, innovation, and quality focus. The cooperative's success stems from effective organisational and marketing strategies, resource management, and adoption of digital tools like ERP systems for centralised data. Its operations feature direct milk collection, cooling centres, and full-scale processing, which enable economies of scale and cost leadership. Product differentiation and proactive market expansion further strengthen its market position. Since opening its plant in 2004, Githunguri Dairy has become Kenya's third-largest dairy processor by 2024, with over 28,000 members delivering over 250,000 litres of milk daily. The cooperative supports farmers with training, resources, and reliable milk markets, while also promoting high-yield breeds and best animal care practices. A well-developed collection network reduces spoilage and logistics costs. Financial stability for farmers is enhanced through the cooperative's SACCO and partnerships with banks, providing greater access to credit. Despite its achievements, the co-operative faces challenges such as rising feed costs and the need for consistently high milk quality, but continues to drive significant positive impact on Kenya's dairy industry.

## Key benchmarking areas from Githunguri Dairy Farmers Co-operative Society Ltd.

1. **Farmer and community-focused innovations**
    - **Academy and demonstration farm:** Githunguri Dairy has established a Dairy Academy and a model farm to train farmers in animal health, farm management, and dairy business skills.
    - **Farmer capacity building:** A continuous initiative designed to train smallholder dairy farmers, including women and youth, to enhance their knowledge and skills, resulting in improved milk quality and quantity.
    - **Farmer involvement:** continuous dissemination of best practices that keep farmers engaged and informed, including providing information on best dairy farming practices.
2. **Internal and human resource innovations**
    - **Strategic human resource planning:** The cooperative has implemented structured mentoring programs for employees and conducts regular evaluations of job descriptions against key performance indicators (KPIs).
    - **Benchmarking:** the cooperative has set aside a budget to support benchmarking activities for their senior management's knowledge against top-performing companies globally and locally to stay competitive.
    - **Strategic training programs:** The cooperative has deliberate learning programs arranged to ensure staff knowledge aligns with international standards, supporting continuous professional development.
3. **Product and process innovations**
    - **Internal conceptualisation and testing:** The dairy has adopted a framework for the internal conceptualisation, testing, and application of new ideas and strategies.

- **Marketing and distribution:** Githunguri Dairy actively engages in market-oriented activities to respond to market trends, sustain competitive pricing, and capitalise on new market opportunities.

4. **Strategic infrastructure and marketing innovations**
   - **Infrastructure:** The ownership and use of milk coolers, processors, and delivery vehicles to control the quality and distribution of their products.
   - **Milk collection and supply:** The cooperative's capacity to collect milk from a large membership base (over 28,000), maintain 88 collection points, and manage a constant supply through 13 cooling centres.
   - **Technological adoption:** Utilisation of modern equipment, like milk processors and vehicles, for efficient collection, processing, and delivery of products
   - **Stakeholder engagement:** The cooperative conducts regular stakeholder sensitisation and customer satisfaction surveys to address concerns and gather feedback.
   - **Adapting to market dynamics:** Management is focused on optimising resources, responding to market changes, and identifying opportunities to maintain a competitive edge in a volatile market.
   - **Marketing innovation:** The adoption of digital and conventional marketing strategies to reach customers and enhance brand presence
   - **Market position:** Its success as the leading fresh milk brand (Fresha) in Nairobi and as one of Kenya's largest dairy processors.
   - **Customer satisfaction:** Conducting regular customer satisfaction surveys to address concerns and maintain market loyalty.
   - **Market expansion**: Adopting market penetration and expansion strategies, such as entering new markets with existing and new products, is vital for growth and competitive success.
5. **Financial performance, services and empowerment**
   - **Profitability:** Consistent financial success, as demonstrated by increasing sales revenue and profitability, often attributed to the strategic implementation of Cooperatives' generic and grand strategies.
   - **Accessible credit:** The dairy SACCO offers affordable loans and financial services that cater to the needs of smallholder dairy farmers, who often lack access to traditional banking systems.
   - **Fostering savings:** The dairy encourages members to save, thereby building a capital base for investment and increasing financial security.
   - **Financial inclusion:** By providing services to the underbanked, Githunguri Dairy SACCO bridge the gap between mainstream finance and rural communities, empowering individuals to invest in their agribusiness.
6. **Economic and social impact**
   - **Income growth:** The Dairy SACCO has significantly boosted household incomes for dairy farmers, contributing to poverty reduction and improved livelihoods.
   - **Economic development:** The Dairy SACCO has played a vital role in the overall economic development of the Githunguri area by creating employment, stimulating entrepreneurship, and contributing to the national economy.
   - **Food security:** By supporting the productivity of smallholder dairy farmers, the cooperative has contributed to Kenya's food security.
7. **Market access and fair prices**

- **Collective bargaining:** By pooling resources and working collectively, Githunguri dairy cooperative has gained a strong bargaining power in the marketplace and competes evenly with private dairy companies.
- **Reduced spoilage:** Githunguri Dairy, with a robust milk collection network, manages timely milk collection and chilling, reducing spoilage and preserving the quality of the milk delivered to processing plants.
- **Elimination of middlemen:** The Cooperative safeguards its smallholder farmers from exploitation by middlemen, ensuring they get better prices and timely payments for their milk.

## Factors driving success in Kenyan dairy cooperatives

- **Competitive strategies**: Successful cooperatives use strategies such as cost leadership, differentiation, and focus to achieve competitive advantage and improve performance.
- **SACCO performance**: Financial benchmarking is strongly associated with high SACCO (cooperative) performance, indicating that assessing financial health against industry benchmarks is crucial.
- **Operational efficiency**: Benchmarking helps identify areas for improvement in internal operations and processes to achieve higher sales, product quality, and asset growth, notes a study on Githunguri Dairy Cooperative Society.
- **Cost leadership**: Cooperatives can gain a performance advantage by implementing cost leadership strategies, which include achieving economies of scale, reducing production costs, and implementing stringent cost controls.
- **Product differentiation and focus**: Differentiating products and adopting a focus strategy are significant predictors of performance for milk processing firms in Kenya.
- **Strategic implementation**: Successful cooperatives implement strategies like market penetration and joint ventures effectively, leading to positive and significant impacts on their performance.
- **Technology adoption**: Implementing Enterprise Resource Planning (ERP) systems can centralise data, eliminate fragmented information, and improve overall organisational performance by providing readily accessible data to all departments.

## Lessons learned

This survey report highlights the pivotal role of successful dairy cooperatives in Kenya in advancing the dairy sector. Key findings suggest that these cooperatives foster unity, innovation, and quality, resulting in improved milk quality, increased resource sharing, and enhanced market access. Members benefit from training, access to credit, and professional extension services, all of which increase incomes and support sustainable farming practices. Key lessons include;

1. **Central role of cooperatives:** Dairy cooperatives are identified as a driving force behind the advancement of Kenya's dairy sector. Their structure encourages member unity, innovation, and a collective focus on quality improvement.
2. **Key benefits for members:** Members of these cooperatives experience tangible advantages including:
   - Improved milk quality through shared best practices and resources
   - Enhanced market access and stronger negotiating power

- Access to training, credit, and professional extension services, which together elevate incomes and promote sustainable farming

3. **Strategic partnerships:** Collaborations with government, NGOs, and private firms bring in vital resources, technical expertise, and funding. These partnerships amplify the positive impacts on individual farmers and the sector overall.
4. **Economies of scale and market influence:** By pooling resources and leveraging collective bargaining, cooperatives enable members to benefit from economies of scale, maintain competitiveness, and adapt to market changes through ongoing innovation and quality control.
5. **Role of SACCOs:** Savings and Credit Cooperative Organisations (SACCOs) are critical in providing affordable financial services, including loans tailored to dairy farmers' needs. SACCOs help rural farmers access mainstream financial services, invest in their operations, and improve their financial security. Additionally, they offer related services such as veterinary care and training in sustainable practices.
6. **Sustainability impact:** The cooperative and SACCO models contribute to both economic stability and environmental sustainability, positioning Kenya's dairy sector for continued growth and resilience.

Overall, the report underscores that the collective, partnership-driven models of cooperatives and SACCOs are essential for the long-term success and sustainability of Kenya's dairy industry.

# Annex 4: Benchmarking study: Maize milling in Kenya

The report on Kenya's maize milling industry identifies key drivers of success, such as adopting advanced manufacturing practices, investing in modern machinery, securing quality raw materials, and prioritising food fortification. Effective financial management, strong partnerships with maize farmers, and workforce skill development also contribute to industry excellence. Nonetheless, challenges like erratic maize supplies, unreliable power, and high taxes persist. Benchmarking is highlighted as a framework for integrating technological, operational, and relational strategies to achieve high performance. Additionally, the Cereal Millers Association of Kenya (CMA) plays a pivotal role in supporting the industry by advocating for favourable policies, addressing grain shortages, promoting food safety and fortification, and fostering innovation. The CMA's initiatives and collaborative efforts help ensure safe, affordable food for Kenyans and strengthen the agricultural value chain.

## Key factors for successful maize milling

- **Technological adoption:** Roller milling is the main technology for large-scale production of high-quality maize flour. Implementing World Class Manufacturing (WCM) practices, such as Just-In-Time and Total Quality Management, boosts operational performance. Modern equipment and food fortification, especially in large mills, are highlighted as essential.
- **Financing and supply chain:** Access to capital allows for machinery upgrades and expansion. Sourcing maize locally can lower costs and raise incomes, though government policies and infrastructure play a role. Building strong relationships with farmers ensures reliable raw material supply.
- **Operational and strategic success:** Workforce development, overcoming operational barriers (like inconsistent power supply), and continuous improvement are vital. Adopting best practices and investing in training and innovation help firms adapt to market changes and technological advancements.
- **Metrics for success:** Millers track inputs, outputs, extraction rates, waste reduction, machinery downtime, and flour quality to measure efficiency and competitiveness.

## Lessons learned

The survey report on Kenya's maize milling sector identifies several key findings and opportunities for improvement. It emphasises the significance of strong farmer organisations and cooperative structures to enhance grain availability, stabilise prices, and boost rural employment. Robust supplier relationships and investments in infrastructure – such as rural roads, warehouse receipt systems, and silo storage – are highlighted as essential for reducing losses and improving market access. The adoption of advanced manufacturing practices like Total Quality Management (TQM) and Total Productive Maintenance (TPM) is recommended to increase efficiency and reduce waste. Policy-wise, Kenya focuses on food security and mandates that all commercial mills fortify maize flour with micronutrients, though consistent implementation remains challenging for smaller mills. Compliance with Kenya Bureau of Standards' quality and safety regulations is required, and substantial infrastructure investment is deemed crucial for reducing prices and promoting sector growth. Lessons from the Cereal Millers Association of Kenya (CMA) include the effectiveness of self-regulation, adoption of global best practices, and proactive lobbying for favourable policies. The CMA's self-regulatory code has improved food safety, while their advocacy has addressed issues like high import duties and credit access. The report concludes that continuous learning, innovation, and improved financing frameworks are vital for the sector's resilience and competitiveness.

# Annex 5: Best practices in maize milling

This document outlines global best practices for maize milling, emphasising food safety, quality control, and operational efficiency. Key recommendations include:

- **Raw material quality:** Secure high-quality maize from reliable sources and rigorously inspect incoming grains for defects, moisture, and mould.
- **Pre-milling processes:** Clean and condition maize to remove impurities and optimise bran separation.
- **Food safety and hygiene:** Maintain strict hygiene, regularly clean equipment, prevent contamination, and use non-toxic pest control. Workers should wear PPE and undergo regular medical checkups.
- **Moisture and quality control:** Control final flour moisture (12-14%) for shelf life and use sifting/grading for product uniformity. Implement HACCP systems and comprehensive record keeping.
- **Operational efficiency:** Utilise modern equipment (digital sorters, dehuskers), follow a rigorous cleaning and maintenance schedule, and use FIFO inventory to ensure freshness.
- **Milling process:** Use maize-specific equipment, dehull and mill for optimal extraction, and ensure regular inspection of all machinery.
- **Packaging and storage:** Employ moisture/oxygen-proof packaging, clear labelling, and cool, dry, palletised storage to prevent spoilage and contamination.
- **Capacity utilisation:** Factors such as raw maize quality, effective cleaning, and process management (including proper grinding and extraction rates) are crucial for maximising yield and efficiency.

Summary: Effective maize milling relies on high-quality raw grains, thorough cleaning, accurate moisture management, rigorous hygiene, pest control, secure packaging, and strong traceability.

# Annex 6: Best practices in beef processing

This section outlines best practices and operational priorities for beef processing facilities:

## Key areas of beef processing

- **Food safety:** Stringent hygiene, the use of dedicated equipment, rapid chilling, and the implementation of HACCP systems are essential for preventing contamination and ensuring high product quality.
- **Facility and equipment:** Facilities should be designed for cleanliness, with proper cooling, lighting, and dedicated tools for different species and product types to minimise cross-contamination.
- **Animal welfare:** Humane handling, pre-slaughter inspection, and stress minimisation contribute to both animal welfare and meat quality.
- **Processing steps:** Efficient stunning, bleeding, hide removal, evisceration, splitting, chilling, and fabrication are crucial. Carcasses should be handled to prevent faecal contamination and promptly chilled below 3°C.
- **Personnel hygiene:** Staff must follow strict hygiene protocols, including handwashing, wearing protective clothing, and regular cleaning and sterilisation of equipment.
- **Sanitation:** Thorough cleaning and drying of equipment and surfaces, along with clear separation of raw and cooked products, are critical to prevent bacterial growth and cross-contamination.

## Operational efficiency priorities

- **Production efficiency:** Focus on throughput, reduced cycle times, equipment utilisation, labour productivity, and inventory management.
- **Quality and safety:** Maintain high standards for meat quality, food safety compliance, temperature control, sanitation, and traceability.
- **Waste management:** Reduce waste through optimised processing and utilise byproducts efficiently; manage disposal to minimise environmental impact.
- **Cost management:** Control raw material, labour, and energy costs through negotiation, streamlined operations, and energy-efficient practices.

**Summary:** A successful beef processing facility emphasises food safety, operational efficiency, animal welfare, and environmental responsibility at every stage, from animal intake and slaughter to product fabrication and waste disposal.

# Annex 7: Best practices in dairy processing

This section provides a comprehensive overview of best practices for health and hygiene in milk processing plants, emphasising their critical role in ensuring dairy product safety and quality. It highlights the following major areas:

1. **Hygiene and sanitation:**
    - Strict protocols for cleaning and sanitising equipment, storage tanks, and milking machines.
    - Facility design focused on smooth, impervious, and easily washable surfaces.
    - Rigorous personnel hygiene, including protective clothing and handwashing protocols.
2. **Quality control and safety:**
    - Routine assessment of raw milk for contaminants and microbial presence.
    - Rapid and consistent temperature control throughout processing to inhibit microbial growth.
    - Careful monitoring of pasteurisation and other core processes.
    - Implementation and ongoing review of a HACCP plan to identify and manage hazards.
3. **Operational practices:**
    - Complete traceability systems from farm to consumer for transparency and rapid response to issues.
    - Regular maintenance and inspection of all equipment to ensure reliable operation.
    - Comprehensive staff training in hygiene, safety, and quality standards.
    - Effective waste and effluent management to keep food production areas uncontaminated.
    - Frequent internal and third-party audits to maintain compliance and drive improvement.
4. **Facility and environmental controls:**
    - Adequate ventilation and lighting for safe food handling and thorough cleaning.
    - Protective measures in loading areas to prevent temperature-related spoilage.
    - Preventing cross-contamination through designed airflow and protected light fixtures.
5. **Process and quality control details:**
    - Use of filters and proper equipment handling to avoid foreign material contamination.
    - Maintaining required temperatures during all stages, including rapid cooling and proper pasteurisation.
    - Systematic sampling and testing of milk to verify safety and composition.
6. **Cultural and regulatory emphasis:**
    - Maintaining a culture of cleanliness, ongoing training, and strict adherence to regulatory standards.
    - Recognising that robust health and hygiene practices are fundamental to public health and the reputation of the dairy industry.

**Summary:** Overall, the best practices in dairy processing underscores that diligent application of these health and hygiene practices ensures the delivery of safe, high-quality dairy products, protects public health, and sustains consumer trust and industry success.

# Annex 8: Best practices in cashew processing

Effective cashew processing requires timely harvesting, proper drying to lower moisture below 8-10%, steaming or hot air cooking to make shells brittle, automated shelling and sifting with precise control, drying kernels to less than 5% moisture, manual and automated grading and peeling, and finally hermetically sealed, food-grade packaging in a cool, dark, and dry environment to preserve quality and prevent spoilage. Food safety measures, such as metal detection and quality control inspections, remain essential throughout the entire process. This document provides a comprehensive overview of the cashew nut processing industry, detailing both the step-by-step production process and the key parameters for operational efficiency and quality control.

## Cashew processing workflow

- **Harvesting & Pre-processing:** Mature cashew nuts are harvested and transported with care to avoid damage. They are then dried (either sun-dried or mechanically) to reduce moisture content to 8-10%, preventing mould and preparing them for further processing.
- **Processing Stages:** The dried nuts undergo heat treatment (via steam, hot air, or oil) to make their shells brittle. Mechanised shelling and sifting expose the kernels and separate them from shell fragments. Kernels are then dried further to below 5% moisture, ensuring a crisp texture and longer shelf life. Next, the thin outer skin (testa) is removed through peeling, either manually or with air pressure. Grading and sorting follow, using both manual and automated methods to identify the size and quality of kernels. Metal detection is incorporated to eliminate contaminants.
- **Packaging & Storage:** Finished kernels are packed in hermetically sealed, food-grade containers and stored in cool, dry, dark, and well-ventilated areas to maintain quality and prevent spoilage.

## Operational efficiency parameters

- **Throughput & Yield:** Factories measure throughput as the rate of raw nuts processed (kg/hour or day) and yield as the percentage of usable kernels (whole or broken) obtained. High yields of whole kernels are especially valued.
- **Waste & Byproducts:** Shell waste and peeling waste are tracked, with some byproducts reused for fuel or animal feed.
- **Energy Consumption:** Monitoring overall and specific energy use per production unit is essential for efficiency.
- **Labor & Time:** Labor requirements are measured per processing stage, and timing for each step (roasting, drying, etc.) is monitored, as these affect overall productivity.
- **Quality & Grading:** Quality is determined by kernel size, colour, flavour, and shape. High-quality grades command better market prices.
- **Other Considerations:** Equipment efficiency, raw material and packaging costs, and process automation are all carefully managed to ensure profitability and consistency.

**Food Safety and Quality Control:** Throughout the process, strict food safety measures – such as metal detection and pest control – are implemented to prevent contamination. Regular quality control inspections at multiple stages ensure high standards. Automation in processes like shelling, drying, and packaging enhances both hygiene and efficiency. Maintaining traceability and clear accountability is emphasised to ensure transparency in the production chain.

**Summary:** Cashew processing is a meticulous, multi-stage process that balances efficiency, quality, and safety. Operational excellence depends on careful control of each step, from raw material handling to final packaging, with ongoing monitoring of key performance indicators and rigorous adherence to food safety standards.