HOW TO ESTIMATE THE QUALITY OF RAW CASHEW NUTS (RCN)?
The Competitive Cashew initiative ComCashew presents a new and innovative model of broad-based multi-stakeholder partnership in development cooperation. ComCashew is mainly funded by the German Federal Ministry for Economic Cooperation and Development (BMZ). Private and public companies are also contributing in cash and in kind. These are: FairMatch Support, African Cashew Alliance (ACA), Trade and Development Group, Intersnack, Kraft Heinz, Olam, Red River Foods, Ministry of Food and Agriculture of the Republic of Ghana (MoFA), the Conseil Coton Anacarde Côte d’Ivoire, Sustainable Trade Initiative (IDH), United States Agency for International Development (USAID), INCAJU Mozambique, Walmart, Direction Générale de la Promotion de l’Economie Rurale, Burkina Faso (DGPER).

ComCashew’s main objective is to increase the competitiveness of Cashew Smallholders, Processors and other actors in the value chain and achieve a lasting reduction of poverty in the project countries, namely Benin, Burkina Faso, Côte d’Ivoire, Ghana and Mozambique. Beyond farmer direct income impact, increasing cashew processing capacity in Africa, the development of sustainable supply chain linkages and supporting a better organization and coordination of the cashew sector, are integrated in the project. Through ComCashew, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and its partners provide training on technical issues, as well as business advice to farmers, processors and facilitate linkages between farmers and processors. ComCashew strengthens initiatives in the cashew sector and responds to questions regarding investment and processing.

The success of the world market relies on the production of a significant volume of excellent quality cashew nuts. For this reason, ComCashew focuses some of its activities on helping cashew nut producers meet international quality standards. In collaboration with its partners, ComCashew provides advice and trainings for each step of the production process: farm management, yield increase, harvest & post-harvest handling, cooperative management and compliance with the specific market requirements.

ComCashew has accumulated valuable experience and knowledge in the production and processing of cashew nuts and its by-products and this resource is shared with industry, notably processors and potential investors in the cashew processing sector in Africa.
This technical manual gives the physical criteria used by the market players worldwide to assess the quality of the raw cashew nuts.

The main criteria used are: Out Turn (Kernels Output Ratio), Moisture, Nut Count, and Total Defective Nuts.

Quality control of Raw Cashew Nut requires skills and strictness; this is one step in the marketing of raw cashew nuts.

This manual aims to make easier the training of quality inspectors specialized in the quality control of raw cashew nuts.

This manual has been designed from field experiences carried on by the following partners:
WHICH PARTS OF THE FRUIT OF THE CASHEW TREE ARE USABLE?

1. **The kernel**: it is mainly consumed roasted and salted. Crushed kernels are used in the food industry (chocolate factory, pastry factory, biscuit factory). The pressing of the kernels gives oil used to produce cosmetics or in food preparations.

2. **The balm**: also called Cashew Nut Shell Liquid (CNSL); it has several uses in the industry. Extracted from the shell, this liquid is mostly composed of anacardic acids; it is used, after purification, in the chemical products manufacturing. This liquid is dangerous; it cannot be handled with bare hands. Its handling requires use of oil, gloves, etc.

3. **The apple**: it is juicy, lightly flavoured, sour and with a lot of vitamin C. This apple is edible. Juice can be extracted from the apple to produce alcohol, vinegar and syrup.

4. **The shell**: the empty shell is used as a fuel to drive the nuts processing (cooking or drying).

5. **The peel or testa**: sometimes, they are used either like the shells or to complement livestock food; they also can be used to make dyeing.
WHO ASSESSES THE RAW CASHEW NUTS QUALITY?

During the raw cashew nuts marketing, quality control occurs at several levels:

- **Farmers**
  Farmers ensure the quality of the cashew nuts they sell in order to get the right price by the buyers.

- **Local buyers**
  They assess the quality of the cashew nuts they buy in order to avoid the return of bad batches from their clients (local processors, exporters).

- **Exporters**
  Most of the raw cashew nuts produced in Africa are, then, exported to Asian countries (India, Vietnam). In big exportation harbours (such as Abidjan, Tema, Lomé), the exporters always check the quality of the cashew nuts batches coming from the productive areas.

- **Local shelling factories**
  Quality control is carried out when the cashew nuts arrive in the shelling factories. If the processing occurs after a long time, the cashew nuts quality can decrease. That’s why this is important to check the cashew nuts quality just before their processing; then you can anticipate the productivity after the shelling.

Therefore, the quality control occurs throughout the supply chain.

Quality is assessed throughout the cashew nuts marketing.
WHY IS THE QUALITY CONTROL OF THE RAW CASHEW NUTS NECESSARY?

During a commercial transaction between a farmer and a tracker for instance, several criteria can be used to specify the cashew nuts quality: colour, shape, brightness, exterior aspect.

But the most important is the quality of the kernel inside the shell.

Cashew nuts buyers are actually processing factories, who need good cashew nuts, to get good kernels to be dispatched.
CRITERIA USED TO ASSESS THE QUALITY OF THE RAW CASHEW NUTS

1. **The OUT TURN or KOR (Kernel Output Ratio)**
   In general, Out-turn means the amount of usable kernels after de-shelling the nuts. It is expressed in lbs quality, which just means the weight of **useful kernels** weighed in pounds in one 80 kg jute bag of RCN. Out-Turn can also be called KOR (Kernel Output Ratio) or kernels output.

   **Example**: an Out-turn of 49 lbs/bag of 80 kg means that we can have 49 lbs (22.2 kg) of kernels usable by the manufacturer if we shell 80 kg nuts.

   To package the cashew nuts, we use gunny bags of 80kg; they are the bag usually used to store cocoa. We assess the kernels quality in these 80 kg-bags. Then the kernels are sold in pound. That’s why the Out-Turn means kernels weighed in lbs in 80 kg-bags.

2. **The DEFECTIVE NUTS RATE**

   The conversion lbs/kg is a conversion between the metric system and the English system:
   
   - $1 lb = 0.45359 kg$ (or also $11.33 kg = 25 lbs$)
   - $1 kg = 2.2 lbs$

   The Out-Turn is an important parameter for the user to control the nuts quality. The nuts prices are determined according to the nuts quality; thus these users will be able to avoid the underestimation of their products by shady buyers. Indeed they will know how to fix the right price. The value of the Out-Turn can also make them able to improve the technical route.

3. **THE DEFECTIVE NUT RATE**

   The defective cashew nuts rate gives the quantity of defective nuts of the sample: premature kernels, spotted kernels (blue category) + Stunted kernels, Void nuts, Moth-eaten kernels, Mouldy kernels, Brown kernels (red category).

   To determine this rate, we weight the kernels and the shells of these two categories. It is expressed in percentage. In general, a sample with more than 24% of defective nuts is rejected.

   This is faster and easier to calculate the defective rate than the Out-Turn; therefore it is used to have a first insight of the batch quality.

4. **The NUT COUNT**

   This is the number of nuts per kilogram; it is expressed in nuts/kg. In practice, it fluctuates between 150 and 240 nois/kg. The smaller is the number, the bigger are the nuts.
Combined with the Out-Turn, the Nut Count gives information about the kernels size that we might get after the shelling.

Indeed the bigger are the nuts and the higher is the Out-Turn, the more likely we are to get big kernels. Big kernels are especially easily sold on the world market.

4 THE MOISTURE RATE
This is an important element concerning the nuts storage. It is expressed in percentage. It has to be under control from the harvest to the shelling. This is better to keep this rate under 10% after the drying. Over 10%, nuts are likely to go mouldy; however if the rate is too low (under 6%) kernels become dry and loose weight. There is a shortfall for the seller. Moreover Kernels too dry are too flimsy during the processing. Therefore the moisture rate has to be between 7 and 10%.

The Out-Turn makes farmers able to correct some weaknesses of the technical route, but it is also very important for the nuts marketing. Indeed marketing is an important step for all the players of the cashew chain because this is when the quality is defined. The nuts price are set according to the value of the Out-Turn of the product. Thus, the player who knows the Out-turn is able to negotiate prices. Buyers (often from Asia) are specialists in this area, therefore local farmers and buyers have to know the Out-Turn to avoid the underestimation of their products.

Here are the steps to assess properly the quality of the cashew nuts batch.
STEPS OF
THE QUALITY CONTROL

1. Material to weight:
one electronic balance
   with a precision of 0.5 gram

2. Material to take nuts:
   from the bag:
catheter bag

3. Material to open the nuts:
   one pair of scissors especially
designed for shelling raw
cashew nuts

4. Material to separate the
   kernel from the shell:
   One scooper (could be
   adapted from a screw driver
   or made by local crafts men)

5. Plastic buckets:
   for the samples
   [one bucket/one sample]

6. 4 plastic bowls to store kernels and nuts during the analysis.
The use of bowls of different colours [green yellow, red, blue]
would make easier the sorting out of the kernels

7. A pair of latex gloves
to protect hands
STEPS OF
THE QUALITY CONTROL

Nuts are taken from the stocks of different places: directly at the farmer's place, or in local shops, or in big shops, or in cargos, or in warehouses at the harbour. Quality can be checked on any nuts stocks.

First a sample has to be taken. Sampling is an important step in calculating the Out-Turn, it has to be done carefully by following a specific process.

Examples of nuts batches:
Here a truck is unloaded at the Abidjan harbour. During the unloading of the truck, nuts are taken from bags by a sampler with a catheter bag. This sampling is generally done in one every ten bags for big batches (30-40 tons) or in one every 5 bags for small batches (15-20 tons). For the buyer, it is useful to take a sample in each bag for a better accuracy and to prevent suppliers from hiding bad-quality bags in the middle of the batch.

The quantity of nuts taken in the entire batch is scraped up on a flat area. This quantity is the “mother-sample”. Then a sample has to be taken for its analyse. The “quarter method” has to be followed to take the sample.

This is a 3-steps method: mixture of the “mother-sample”, composition of the “quarters”, and composition of the samples to analyse.

Mother-sample

Here the sampler mixes the mother-sample; this has to be done carefully in order to get a homogeneous pile.
The mother-sample is divided into 4 parts more or less equal. Each part is called “quarter”. We have 4 quarters: two to two opposite.

Therefore:
- the first quarter is opposite to the third quarter
- the second quarter is opposite to the fourth quarter.

Each sample has to come from two opposite quarters. For this, we take small amounts more or less equal of nuts in the opposite quarters; we mix them in a bucket.

Thus we get:
- sample 1 from the first quarter and the third quarter
- sample 2 from the second quarter and the fourth quarter.

See next page for details
SAMPLE 1:
quarter 1 + quarter 3

SAMPLE 2:
quarter 2 + quarter 4

HOW TO COMPOSE QUARTERS?
Each sample, composed like described before, is weighed to get about 1 kg of nuts. Let $W_1$ be the weight of a sample.

! WRITE THE RESULT !

$W_1 = ...$

It can fluctuate between 998 g and 1002 g.

It can be useful to keep a witness-sample of about 1 kg to check in case somebody contests the results.
After the weighing of the sample, we calculate how many nuts are in the sample.

During this step, we also check if foreign matters are in the batch (leaves, stones, dry apples, branches).

Thanks to the nuts piles, this is easy to know how many nuts are in the sample by counting the number of 10-nuts piles and the extra nuts.

Example: for 193 nuts, we will count 19 piles of 10 nuts + 3 nuts

For each sample the nuts are brought together in small piles of ten nuts: this will avoid mistake during the counting.
Each nut (shell and kernel) of each sample is cut through with the help of a specially designed scissors; thus we get two halves with or without flaws. The split nuts are classified according to their characteristics.

Make sure that the two halves of each nut are kept together and that the kernels stay with the shells.

Notice the position of the nut in the scissors, cut slightly the nut lengthwise, dry the scissors after each cutting.

Use gloves; the test has to be done in good light.

By observing these split nuts, we can observe the kernels and classify them into three categories:

- Wholesome kernels (100% accepted)
  SEE TAB, GREEN COLOUR
- 50% rejected kernels
  SEE TAB, BLUE COLOUR
- 100% rejected kernels
  SEE TAB, RED COLOUR

These controlled kernels are put in the bowls according to their category.
GOOD KERNELS

WHOLESALE KERNELS DON'T HAVE ANY FLAW, THUS ALL OF THEM ARE USABLE. THESE KERNELS ARE 100% ACCEPTED.
SPOTTED KERNELS
These kernels have had insect bites before the development of the shell. Thus these kernels bear at least one black spot or one black mark. Parts that don’t have any spot or mark can be consumed. Therefore 50% of these kernels are accepted (or rejected).

PREMATURE KERNELS
These kernels are shriveled, not well developed because of a too early harvest (sometimes by picking). Therefore 50% of these kernels are accepted (or rejected).
STUNTED CASHEW NUTS
They are small nuts with underdeveloped kernels because of a lack of water or because of an abortion on the tree. Thus 100% of these kernels are rejected.

MOULDY KERNELS
These kernels have white marks due to a bad drying or a humid storage. Thus 100% of these kernels are rejected.

BROWN KERNELS
These kernels have stayed too long on the ground; they have an oily, yellowish appearance. Thus 100% of these kernels are rejected.

MOTH-EATEN KERNELS
These kernels have been eaten by insects; this results in a yellow powder inside the kernel. Thus 100% of these kernels are rejected.

EMPTY CASHEW NUTS
These kernels have white marks due to a bad drying or a humid storage. Thus 100% of these kernels are rejected.
**STEPS OF THE QUALITY CONTROL**

This stage has two steps:
1. The weighing of defective kernels.
2. The weighing of usable kernels (kernels 100% or 50% accepted)

Good kernels are removed from the shells with the help of the scooper (or the needle) preferably without removing the peel (or testa). We get on one side kernels (with peel), and on the other side shells. These good kernels are the “100% accepted kernels”. They are put into the green bowl.

These good kernels are weighed with their peel. Let \( W_2 \) be the total weight of the good kernels.

Weight the kernels+shells of the categories (premature and spotted). Let \( W_3 \) be the total weight of the nuts (kernels+shells) 50% accepted.

\[
W_3 = \text{weight of the spotted kernels} + \text{weight of the premature kernels} \quad (\text{kernels + shells})
\]

**WRITE THE RESULT!**
\( W_3 = \ldots \)

In the same way, each other category of defective kernels (mouldy, brown, moth-eaten, empty, and stunted) is weighed with the shells. Let \( W_5 \) be the total weight of the nuts (kernels+shells) 100% rejected.

The kernels (premature and spotted) are removed from their shells. All these kernels are “the 50% accepted (or rejected) kernels”. They are put into the blue bowl.

The kernels (premature and spotted) are weighed. Let \( W_4 \) be the total weight of the 50% rejected kernels.

**WRITE THE RESULT!**
\( W_4 = \ldots \)

\( W_5 = \ldots \)
**STEPS OF THE QUALITY CONTROL**

**Calculation of the Nut Count**
This is the number of nuts per kilogram. It is calculated by dividing the number of nuts in the sample by the weight of this sample: we obtain the value of the grain. The grain gives information about the average size of the kernels. The bigger the grain value, the more there are nuts in one kilo and so the smaller are the nuts.

\[
\text{Nut Count} = \frac{N}{W_1}
\]

With:
- \(W_1\) : the weight of the sample
- \(N\) : the number of nuts counted in one sample  
  [see tab 4]

**Calculation of the total defective rate**
To calculate the defective rate, you have to use the following formula with the data from the weighing (see tab 6).

The defective rate is:

\[
\frac{(W_3 + W_5)}{W_1} \times 100
\]

With:
- \(W_1\) : the total weight of the nuts sample
- \(W_5\) : the weight of the 100% rejected nuts
- \(W_3\) : the weight of the 50% rejected nuts

**Calculation of the kernels productivity and of the Out-Turn**
To calculate the kernels productivity, you have to use the following formula with the data from the weighing. [see tab 6].

\[
\text{% of useful kernels} = \frac{(W_2 + W_4/2)}{W_1} \times 100
\]

With:
- \(W_1\) : the total weight of the nuts sample
- \(W_4\) : the total weight of kernels + peels of 50% rejected nuts
- \(W_2\) : the total weight of kernels + peels of the good kernels

**EXPLANATION**
- The productivity in % is converted in a value expressed in weight/weight (for that, we divide % of useful kernels by 100).
- To reason with 80kg-nuts bag, we multiply by 80.
- To get a value in pounds, we divide by the value of one pound in kg (1lb=0.45359 kg)

In practice, the values of the Out-Turn fluctuate between 40 and 50 lbs per 80 kg of nuts. When the Out-turn is high, the batch has a good quality.

**GOOD QUALITY = GOOD PRICE**

For the processors, all reasoning connected to the purchase and the processing of cashew nuts are conducted on the base of a 80 kg-nuts bag and of a weight of kernels expressed in pounds (lb).

Thus the productivity Ra becomes the Out-Turn with the following conversion:

\[
\text{Out-Turn} = \frac{\text{% of useful kernels}}{100} \times 80 \times 1/ 0, 45359
\]
STEPS OF
THE QUALITY CONTROL

- Material used to calculate the out-turn
- Sampling-taking of the “mother-sample”
- Weighing of the sample
- Calculation of the nut count
- Opening of the nuts, control of the kernels, and classification into 3 categories
- Weighing
- Calculations
CALCULATION OF THE TOTAL DEFECTIVE RATE

195 g + 33 g = 228 g

Weight in g

114 g

Weight in g

116 g

Weight in g

All useless kernels: 230%

% of all useless kernels: 23%

CALCULATION OF THE OUT-TURN

Weight in g

15 g + 24 g = 39 g

Weight in g

7.5 g + 12 g = 19.5 g

Weight in g

283.5 kg

All useful kernels

OUT TURNT = All useful kernels (g) x 80 (kg)

OUT TURNT (60 kg) = All useful kernels (g) x 80 (kg)