



Strategy for establishing a traceability system for a cottonseed oil production unit in Côte d'Ivoire

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Abstract

Initially defined as a quality management tool, traceability is succeeding in improving the performance of industrial production systems throughout the world. However, in Côte d'Ivoire, some food processing industries such as COTRAF have unreliable traceability systems. This absence of traceability is due to a lack of quality control requirements on the part of consumers. A study was therefore carried out in the town of Korhogo at the COTRAF company.

The overall aim of the study was to help improve the performance and competitiveness of cottonseed oil processing units. For this reason, the methodology used involved a preliminary survey, the purpose of which was to interview the company's managers. Then, the actual survey was then carried out on a sample of twenty-two (22) staff members. The evaluation of the cottonseed oil production procedure and the analysis methods were described. Statistical tests were carried out to determine the functional organisation of COTRAF. The results prove that the organisation of COTRAF refers to traceability indicators. This indicates the level of satisfaction with their traceability system. The RADA and PARETO diagrams showed significant levels of compliance of COTRAF's organisation with the prerequisite standards (59.32% of prerequisite standards). With regard to coding procedures, practised traceability logics have made it possible to determine codes based on COTRAF's organisation. Based on the above data, a traceability scheme was proposed. Ultimately, the creation of a reliable traceability system within COTRAF is desirable, as there is already a system that performs poorly in terms of reliable indicators, which represent 59.32%.

Keywords: COTRAF; Traceability; Refined cottonseed oil; Codification; Standards; Quality

1. Introduction

Côte d'Ivoire, a West African country, has been able to exploit its agroecological assets to develop a certain number of agricultural crops such as cotton (Yao, 2013).

Cotton (*Gossypium spp*) is Côte d'Ivoire's third most important export. It accounts for 5 to 10% of export earnings (Aiwa, 2015). In terms of cotton production, Côte d'Ivoire has increased its cotton fibre production from 230,000 tons in 2020 to 242,000 tons in 2021. This increase in production ranks the country fourth in terms of African production. Nearly 3.5 million people in the northern regions of Côte d'Ivoire live directly or indirectly from cotton growing (CCIC, 2021). As a result, cotton is the lifeblood of the area's economy and the main source of income for rural populations (Minagra and Intercoton, 2013; CCA, 2019).

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All the cotton harvested is ginned locally to produce cotton fiber, which is the main product used in the manufacture of fabric and by-products Minagra and Intercoton (2013). The most important by-product is the seed, which is used in the manufacture of cosmetic oil, soap, edible oil and oilcake. Refined cottonseed oil is essentially the second most consumed oil in Côte d'Ivoire after palm oil. Average national oil consumption is estimated at more than 180,000 tons of oil per year (FAO, 2017; CCA and IFC, 2019).

Nationally, COTRAF SA is the leading producer of cottonseed oil, with an average annual output of 1440690 tons. Its annual production is around 47000 25-litre cans of oil and 26269 10-litre cans. It employs over 300 people (COTRAF, 2023). COTRAF SA plays an important role in creating jobs and contributing to the population's food needs. However, it faces a few constraints in the production of cottonseed oil. The most important of this concern the monitoring of supplies from the loading of raw materials and the management of data relating to processing, as well as the lack of a reliable traceability system. According to ISO Standard 8402: 1994 (Quality management and quality assurance - vocabulary), traceability is the ability to trace the history, use or location of an entity (activity, process, product, organisation, person, etc.) by means of recorded identification. To this end, implementing a traceability system helps to reinforce the sense of transparency and proximity that consumers feel. Traceability gives products a competitive edge and differentiates them on the local and international markets. For example, for example, the use of the traceability system by SN Citec in Burkina Faso demonstrates the benefits for the company and its customers (SN Citec, 2014). Indeed, consumers of the said company claim satisfaction when purchasing because they have information regarding the origin, standards and physicochemical analyses carried out on the oil consumed. Knowledge of how to set up a traceability system is essential to ensure the performance of Ivorian processing companies (CCA, 2015). Today, it is vitally important for the agricultural sector to comply with market requirements while putting in place good management of the organisation of processing units and a quality approach based on standards (FAO, 2017). So, wouldn't traceability be a solution to the poor management and organisation of food processing units?

It was with a view to promoting this quality tool within industries in the north of Côte d'Ivoire that this study was carried out on the theme << strategy for establishing a traceability system for a cottonseed oil production unit in Côte d'Ivoire>>.

2. Material and methods

2.1. Plant material

The plant material used in this study consisted of cotton seeds from cotton granulation companies located in Côte d'Ivoire (**Figure 1**).



Figure 1 Cleaned cotton seeds

2.2. Methods

2.2.1. Pre-survey

This phase of the study consisted firstly of talking to COTRAF managers about information on the company's supply, processing, packaging and profitability. Secondly, to get to know the COTRAF oil mill, which lasted two weeks. Following this interview, a schedule of meetings with the agents was drawn up. Finally, a tour of the company was carried out in

order to get to know the subdivisions into which the agents working with COTRAF are grouped. This step enabled contact to be made with the millers to gain a better understanding of the cottonseed oil production stages. This meeting was also beneficial in that it enabled us to forge links with the workers. These contacts facilitated communication during the consultation with the various managers and agents of the structure.

2.2.2. Survey

The diagnosis was carried out over a period of three (03) weeks after the pre-survey. It consisted of collecting information from oil mill workers. The question-and-answer technique (open and closed questions) was used to fill in the questionnaire.

2.2.3. Sampling

The target audience for the study was COTRAF's managers and staff. The choice of agents to carry out this study was dictated specifically, on the basis of the list of personnel made available to us by the company's managers. Thus, the reception, production, packaging, laboratory and sales departments were visited to administer the questionnaire. The survey sample consisted of 22 oil mill employees.

2.2.4. Production of refined oil or the COTRAF process

The extraction of oil from cotton seeds starts with the cleaning and hulling of the seeds, the flattening of the kernels, cooking and then continuous screw pressing. After these operations, the resulting collars undergo solvent extraction. This consists of leaching or percolating in counter-current the collars to be de-oiled using hexane heated to between 50 and 60°C. The miscella (oil + hexane) is distilled to separate the oil from the solvent. COTRAF uses the following process to produce refined cottonseed oil:

- Reception and cleaning of cotton seeds
- Cottonseed hulling
- Kernel flattening
- Physico-chemical analysis
- Extraction of the crude oil
- Neutralisation of the crude oil
- Conditioning and storage.

2.2.5. Physico-chemical analyses

The physico-chemical parameters of refined cottonseed oil samples are checked for moisture, acid, peroxide, saponification, ester, iodine, insoluble impurities and traces of soap. This also includes the detection of unsaponifiable matter and total ash in the oil.

The samples intended for physico-chemical analysis in the laboratory were taken from the tank in which the refined oil produced was packaged. Production takes place throughout the day. At the end of each production run, the sample was taken from the conditioning tank and transferred to sealed bottles. Each sample is recorded before analysis.

2.2.6. Data processing

SPHINX version 15 was used to design the database and Excel to produce the graphs. This software was used to perform a statistical analysis, with the ethic of scientifically demonstrating the performance level of the company's provisions, using the data collected.

3. Results

3.1. Organisation of the production unit

3.1.1. Organisation of cottonseed supply

COTRAF's suppliers

In close collaboration with several cotton companies, COTRAF has a cottonseed delivery contract with these companies. These various suppliers, namely COIC, SECO, CIDT and IVOIRE COTON, supply quantities predefined by the delivery contract. These companies are located in Korhogo, Ferkessédougou, Bouaké and Boundiali. The company COIC SA is the

largest supplier, accounting for 62% of the quantity supplied, while the smallest quantity is delivered by the supplier CITD, with a proportion of 5% (Table 1).

Loading or collection of cotton seeds

As regards the collection of cotton seeds during the cotton season, COTRAF has agents at the various loading sites. These people are responsible for checking the seeds before they are loaded onto the lorries. The collection of seed lots is organised initially by the factory or supplier. Depending on the predefined quantity, trucks are made available for loading.

However, when the predefined quantities are not reached, a group collection system (which consists of collecting seeds from different companies together) is set up to load the lorries. The documents used by the inspectors to monitor collection activity are numbered tickets.

Receipt of cotton seeds

The various loads, from separate or grouped suppliers, are transported to the COTRAF factory. On receipt, the lorries are identified by cards which record the quantity of cotton seed unloaded, the date of unloading, the lorry number, the ticket number and the quantity of seed transported per lorry. When the seeds are unloaded, a sample is taken to check their moisture content.

Workforce

At supply level, the workforce is essentially made up of people on occasional contracts, classified into five groups of eight (08) people. The purchasing and logistics managers, as well as some staff in these departments, are permanent workers.

Table 1 List of COTRAF suppliers

Suppliers	Localities	Quantities (%)
COIC	Korhogo	62
SECO	Ferkessedougou	20
CIDT	Katiola	5
IOIRE COTON	Boundiali	13

3.1.2. Cottonseed processing

Reception, cleaning

Using lifts, batches of cottonseed are dumped into large tanks. COTRAF has two tanks that receive the seeds and facilitate cleaning by the water washing mechanism.

Hulling, Preparation (toasting), Flattening

There are a few important operations involved in producing cottonseed oil for human consumption:

- After cleaning, the seeds are put through hulling machines.

Dehulling separates the cottonseed kernels from the hulls and identifies any physical impurities.

- Preparation by toasting the hulled almonds. This is done by heating the ground seeds to 105°C for 1 hour. The seeds are then cooled for around 25 minutes to release the oil.
- Flattening consists of grinding the roasted almonds into powder. This operation is carried out using hydraulic presses and/or screw presses.

Extraction, refining and degumming

The extraction of cottonseed oil at COTRAF uses more soda. The crude oil is extracted by separating the flour from the crude oil using hexane. This consists of washing or percolating the collars to be de-oiled against the current using hexane

heated to between 50 and 60°C. The miscella (oil + hexane) is distilled to separate the oil from the solvent. This preparation method is based on the **ISO 22005** standard. The extraction monitoring documents are the daily production register and the analysis bulletins.

Neutralisation and washing

Neutralisation takes place in the tank where degumming takes place. This operation eliminates the free fatty acids (FFA), residual extracted phospholipids, reduced colouring matter and reduced protein compounds by transforming them into soap. The purpose of determining the acid number is to determine what to do when neutralising, decolourising and deodorising oils. Caustic soda is used for neutralisation. The analysis method used is **ISO 3596, 2000**. This base removes free fatty acids and virtually all phospholipids from the crude oil. It also eliminates traces of heavy metals (iron, copper, etc.) which are catalysts for certain oxidation reactions.

Washing takes place in another tank fitted with a mixer and a water spray system. The oil is sprayed with hot water (60°C-80°C) 4 to 5 times or more until a light yellow colour is obtained. The operation is repeated 4 to 5 times or more, until all traces of soap have been removed. The analysis method used is **ISO 663, 2000**. After each operation, the emulsion is allowed to settle.

Drying, decolorisation and deodorisation

After washing, the neutral oil is transferred to the drying tank. This tank is equipped with a mixer and a heat exchanger system in the form of coils that transfer heat from the boiler to the oil (steam at 7-8 bar). In this tank, the oil is heated to a maximum temperature of 130°C to evaporate the water and certain volatile substances. 10 to 15 minutes after the end of the drying process, the temperature is brought back down to 90-110°C. The weight of bleaching earth, which is TONSIL, is then between 0.6 and 0.9%, then the mixer is started to allow better earth-oil contact and optimise bleaching for 30 minutes. This operation eliminates pigments similar to gossypol, chlorophyll and its extracted decomposition products.

After drying and decolourisation, the oil is filtered using a filter press. This first filtration removes the bleaching earth from the oil, as well as soap residues, heavy metals, pigments and phospholipids. At the end of filtration, the oil is collected directly in the deodorisation tank.

Analysis of oil physico-chemical parameters

The physico-chemical analysis concerned several parameters, particularly the acid value, the saponification value, the rate of traces of soap and the moisture content of the oil.

For COTRAF SA, the index is determined by titration of the free fatty acids contained in the oil with a sodium hydroxide solution in an ethereal-alcoholic medium. In order to obtain the required quality of finished oil intended for consumption, after the respective stages of flattening and neutralization, the laboratory is responsible for maintaining a reasonable quantity of between 5 -15% of indexes contained in the crude oil. If this value is exceeded, the oil is not fit for human consumption. The saponification index analysis carried out takes into account the traces of soap contained in the crude oil.

Conditioning and storage of finished oil

The oil is conditioned at -40°C in two large tanks containing taps, connected to a conditioning tank. Canisters are filled to order, and every 45 minutes two canisters are filled. Filling takes place in 25-liter cans, which are labelled beforehand.

The oil in the cans is stored by line, according to filling date. There is no specific coding for canister storage.

3.1.3. Sales and delivery

Sales are generally made to order. Distribution companies place large orders. In addition to these wholesalers, the company sells to semi-wholesalers and even retailers. Documents such as the oil drum input/output book, the order form and the delivery form are existing traceability documents. In terms of delivery, it's the customers who pick up their pre-ordered products.

3.1.4. Evaluation of COTRAF's traceability system

This section presents the traceability systems implemented by COTRAF and the existing standards for the stages involved in setting up a traceability system. It includes the traceability requirements, the level of practice according to the standards and the rating assigned.

Level of compliance of the COTRAF company with standards and ratings

The percentage related to the level of compliance of the COTRAF company is presented in Table II and those recommended for the 5 prerequisite programs according to the CODEX. According to Table II, the COTRAF company obtained 35 points out of a total of 57 points or 59.32% of the overall CODEX standards relating to traceability requirements. The compliance program is less than 50% for document management with a rate of 37.50% and 44.44% for the definition of procedures. For the other programs, i.e., defining the context, defining the general objectives, identifying the existing, a rate greater than 50% is recorded.

Point visualization via the Radar Diagram

Radar diagrams (Figure 2) enable us to visualize the prerequisite programs and indicate the weak points in terms of COTRAF compliance percentages. These are the organization and document management programs, with a rate of 37.50%. This diagram is supported by the PARETO diagram, which elucidates the weakest parameters for immediate repair.

Evaluation of the programs to be solved

The results of the assessment are illustrated by the Pareto diagram. According to this result, the first three prerequisite programs in terms of traceability requirements that are not in line with CODEX are: PR5, PR4, PR1 (Figure 3). These are the following prerequisite programs: Organize document management (documentation); define procedures (action plan, associated documentation and recording); identify existing systems (data collection and transmission systems).

The lack of traceability at COTRAF is significant in relation to the CODEX prerequisites.

Table 2I Percentage of compliance with traceability requirements

Abbreviation	Prerequisite programs or standards	Total quotation or point	Points obtained	Percentage	Percentage of standards
PRP1	CONTEXT DEFINITION	12	7	58.33 %	100%
PRP2	DEFINITION OF OBJECTIVES	12	10	83.33 %	100%
PRP3	IDENTIFICATION OF EXISTENCE	9	7	77.78 %	100%
PRP4	DEFINITION OF PROCEDURES	18	8	44.44 %	100%
PRP5	MANAGEMENT ORGANIZATION	8	3	37.50 %	100%
	TOTAL	57	35	59.32 %	100%

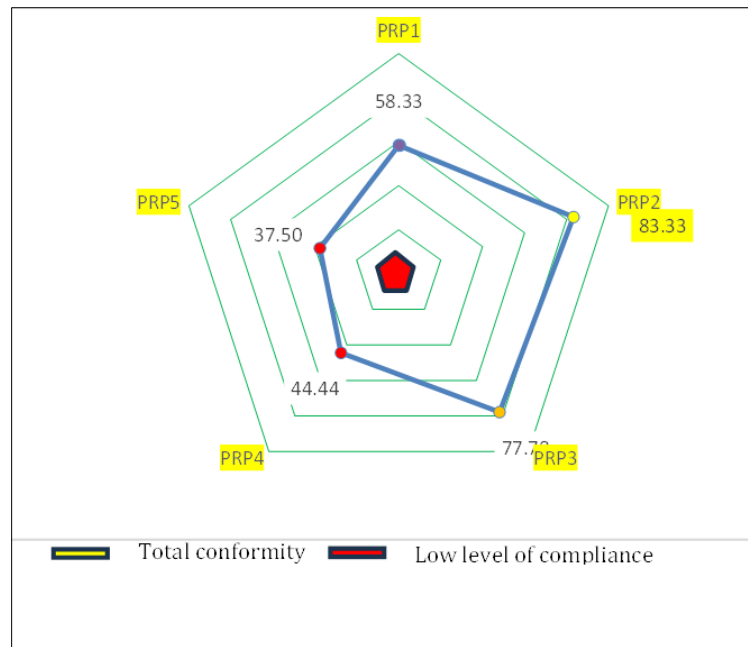


Figure 2 Radar diagram of compliance with COTRAF traceability principles

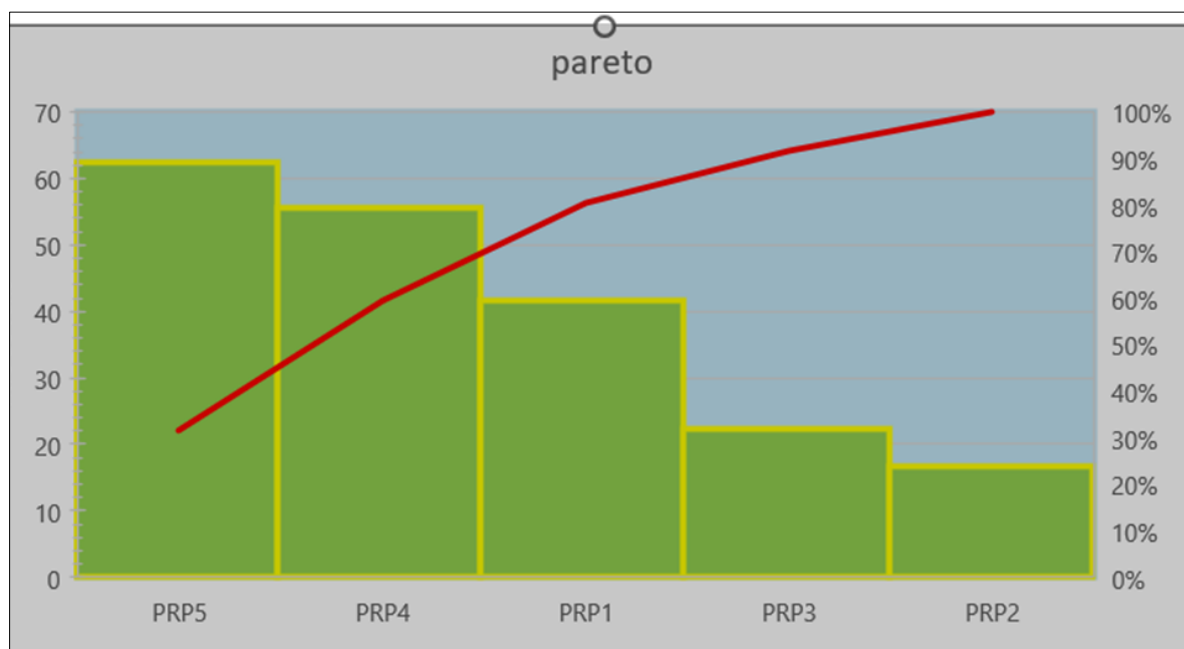


Figure 3 Pareto chart of critical points according to level of compliance with standards

3.2. Procedure for coding production system inputs and outputs

3.2.1. Scope of application

To set up a coding procedure, it is important to begin by defining the scope of traceability. In the context of this study at COTRAF, the field of application concerns firstly the raw material which is transformed into the finished product, then the second part takes into account the stages of preparation, sale and delivery. Thus, the scope of application is designated by :

- the product-process pair
- upstream-downstream limits (supply-delivery)

The upstream-downstream limits enable us to identify the limits of the field of action in the development of sound management strategies.

3.2.2. *Components of each stage*

Supply

For proper tracking of the raw materials acquired by COTRAF, several items of information must be contained at supply level. This includes:

- Supplier
- Raw material batch
- Raw material control reference
- Area of origin
- Delivery date
- Date of receipt
- Transport references

This information will enable COTRAF to trace the cotton seeds it receives.

Trituration

The preparation of cottonseed oil involves several elements. It is therefore important to know certain operating information, such as:

- The crushing batch
- The crushing line
- Machine reference (cooker, mill, flattener)
- Crushing date
- Work team
- Physico-chemical analyses (batch, analysis date, analysis result)

Temporary storage

In the case of storage, information is required to enable decisive monitoring. It takes into account several aspects, namely

- Tank references
- Quantity of finished product stored

Delivery

Delivery is made to order. Important details such as the customer's name, place of delivery, delivery date, transport references and quantity delivered are therefore very useful for good traceability. These clues provide consumers with information about the origin of the seeds used to make the oil. It provides assurance when purchasing products manufactured by the COTRAF oil mill.

3.2.3. *Manufacturing diagram*

The manufacturing diagram illustrates the components at each stage of the transformation process. It considers the various suppliers in partnership with COTRAF in Korhogo. The various raw material loading zones, initial reception and storage workshops are elucidated in the diagram.

At the crushing level, information such as the crushing batch, the crushing line, the machine references, the crushing batch, the date and the work team are shown.

The tracking diagram also shows aspects of temporary storage, with reference to the storage tank, the different locations per batch, the quantity stored and the date of temporary storage. It also records information on the storage of finished products. As for the delivery, it should show customer data and the link between the origin of the seeds and the oil sold (**Figure 4**).

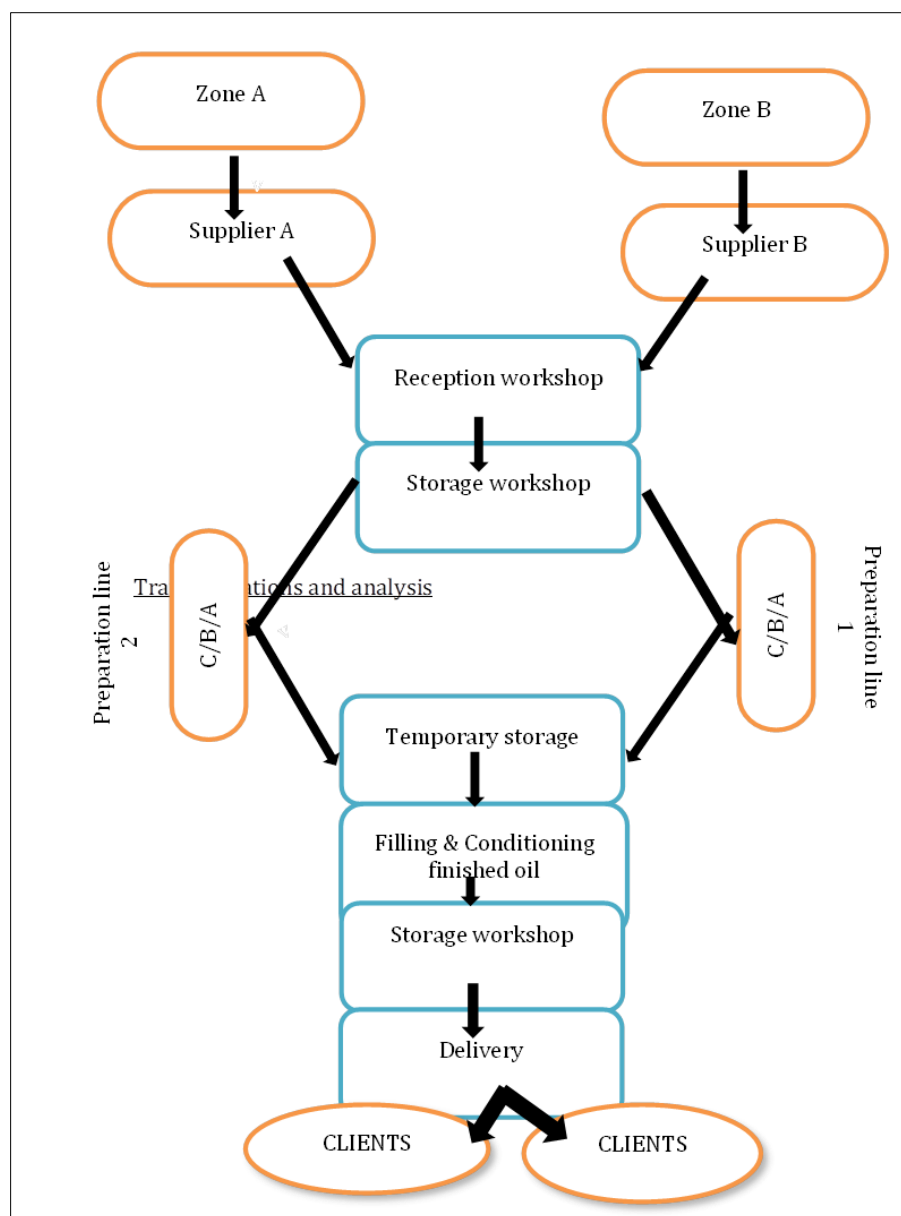


Figure 4 Production diagram

3.2.4. Identification of inputs and products

In this section, we define the products used as raw materials and the finished product.

At COTRAF, the raw material is cottonseed and the finished product is cottonseed oil.

Raw material coding

COTRAF's raw material coding is based on the following elements:

- The supplier, whose code is given by an acronym depending on the number. Thus we have Fco for the supplier COIC, Fiv to designate the supplier IVOIRE COTON,

Fdt for the CIDT supplier and Fse for the SECO supplier.

- The locality or supply zone is marked by the initial letter Z, followed by the locality name, all capitalized and bolded. The Korhogo zone is then noted ZK, ZB is intended to define the Boundiali zone. The Bouake zone has

undergone a modification to the coding rule. It is now referred to as ZBKE. The Ferkessédougou zone is identified by ZF.

- Other references are defined by simplified signs and abbreviations, depending on the condition of the raw material, numbering, date, etc. For example, H1 is used to designate good cottonseed moisture, and H0 when the seed has imperfections.

The reference of the cottonseed truck is given by the letter T to designate the truck and the digits 01 for the truck number, giving T01.

The date of receipt is also decisive for good traceability and is noted as DD/MM/YYYY.

COTRAF's raw material codification for supplier COIC is defined as follows:

Fco, ZKH1, T01-01/01/2023.

This means that this batch of cotton seed comes from the supplier COIC in the Korhogo area, the seeds have a good moisture content and were transported by truck number 1 and received at the COTRAF factory on 01/01/2023.

This first part is very important at COTRAF, as it enables us to differentiate between the seeds that will be used to make oil and those destined for oilcake production. Thanks to the analysis of the moisture content of cotton seeds, there is only one quality of oil required at the end of production, so the risk of having poor quality oil is nil. On this basis, coding is one-sided, as the separation is made at the outset.

Finished product coding

Finished product coding takes into account the different elements of the process:

- The crushing lot is the condensed mass of raw material ready for preparation.

Its code is defined by the first two initial letters followed by the number of its position in the whole and is noted Lo1.

- Production line references: several items of information are coded here, including the type of machine or machine reference, the work team and the date on which the cottonseed oil was prepared.

Thus, the crushing line is simply coded by the letter L followed by the line number. Teams are defined by the letter T followed by the team number, and the date follows the logic DD/MM/YYYY.

At the end of finished oil production, the codification of this oil within COTRAF is written as follows: **Lo1-L1-T1-01/01/2023**. This code means that lot number 1 of cotton seeds has been crushed in line 1, by work team number 1 on 01/01/2023.

Final coding of COTRAF products

The definitive coding of COTRAF products takes into account information concerning the raw material and the finished product. It enables us to trace the history, stages and modifications of data throughout the oil production process, from upstream to downstream.

Definitively at the end of the crushing process for a finished product, the codification is noted:

Fco, ZKH1, T01-01/01/2023** Lo1-L1-T1-01/01/2023.

This finished product coding means that the cotton seed lot comes from the COIC supplier in the Korhogo zone, the seeds have a good moisture content and were transported by truck number 1 and received at the COTRAF factory on 01/01/2023. After receiving the seeds, lot number 1 of cotton seeds was crushed in line 1, by work team number 1 on 01/01/2023. This information, marked on the cans or on the plates in the packaging rows, facilitates storage of the oil produced. All production references, such as supplier, zone, truck references and date, are known upstream. But also the crushing data, i.e. the preparation line, the different types of machine contained in each line, the teams responsible for this preparation and the date are all highlighted. Codification of COTRAF products is an important part of the process of setting up a traceability system.

3.3. Traceability scheme adapted to the company's reality

3.3.1. Definition of a traceability scheme for COTRAF

The implementation of an efficient traceability system is essentially based on a scheme that defines the different stages in the life of cottonseed oil. For COTRAF, the traceability system will make it possible to reassure commercial partners and thus contribute to the positioning of cottonseed oil on the market. The proposed scheme gives all the information at the various stages of the process, from reception of the cottonseeds, to crushing and marketing of the finished oil to consumers.

For the proposed COTRAF organization, all those involved in each stage of the process must set up a documentation system that covers all operations, from raw materials to final products.

To this end, all departments must have the means of recording data to establish the relationship between the cottonseed received and the oil produced at each stage of the process. To achieve this, it is necessary to establish a step-by-step diagram of the cottonseed's life and the link between each stage. Data and information must be collected and recorded on the inputs and practices relating to each stage, and the succession of stages from the purchase of the raw material to delivery of the finished product.

The diagram that emerges from this study for COTRAF considers the records to be maintained at each stage to ensure traceability upstream (procurement), internally (from receipt to delivery) and downstream (after delivery). On the right-hand side are the output documents, which must be completed and filed. On the left-hand side, any input documents required to complete the output documents are recorded (**Figure 5**).

3.3.2. Description of documents and existing relationships

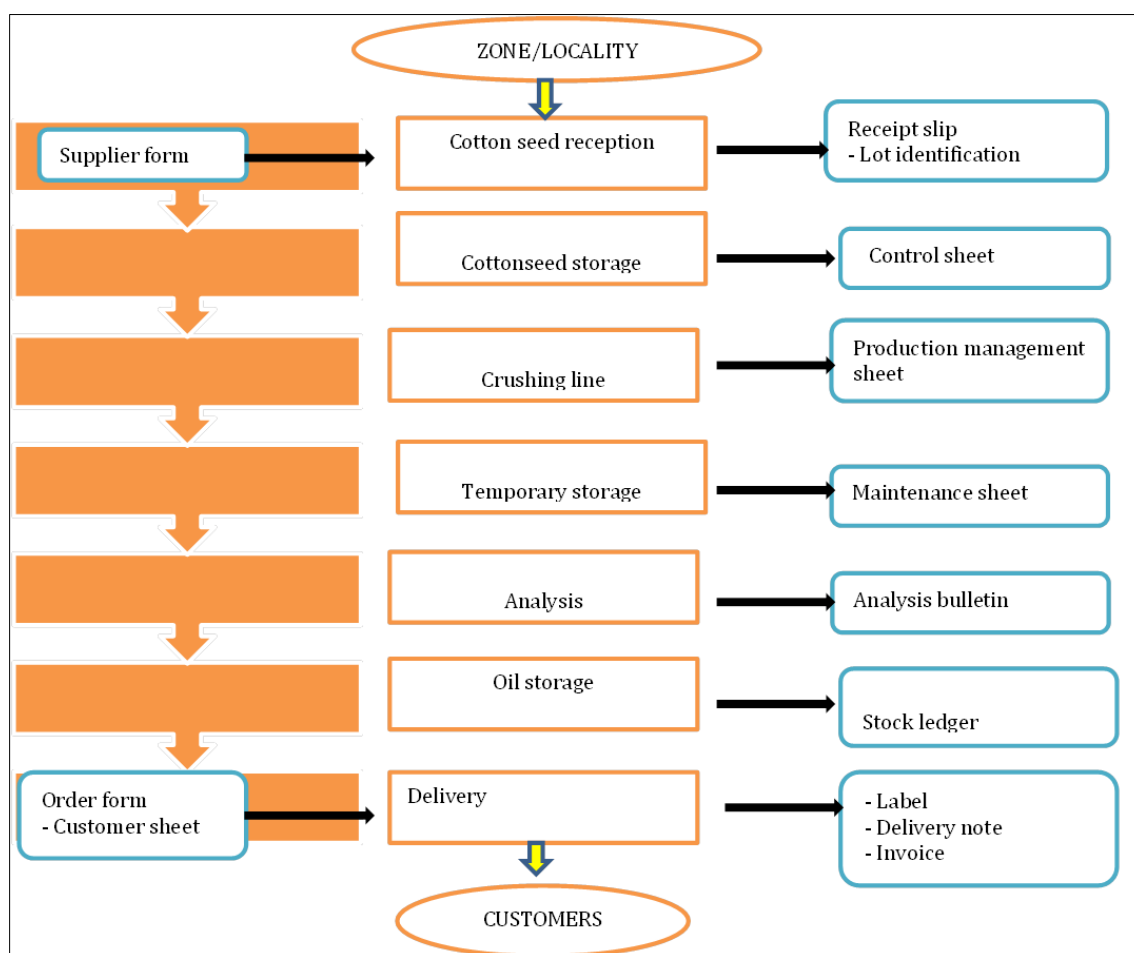


Figure 5 Proposed traceability scheme for COTRAF (information flow)

This is an overview of the various forms (record sheets) essential for recording traceability data (**Figure 6**). It shows the record fields that each record sheet must contain, and the relationship that exists between the different forms specific to traceability (blue sheet), as well as the fields that ensure this relationship. The relationship between the various traceability forms and other record sheets that may be part of another documentation system (green sheets).

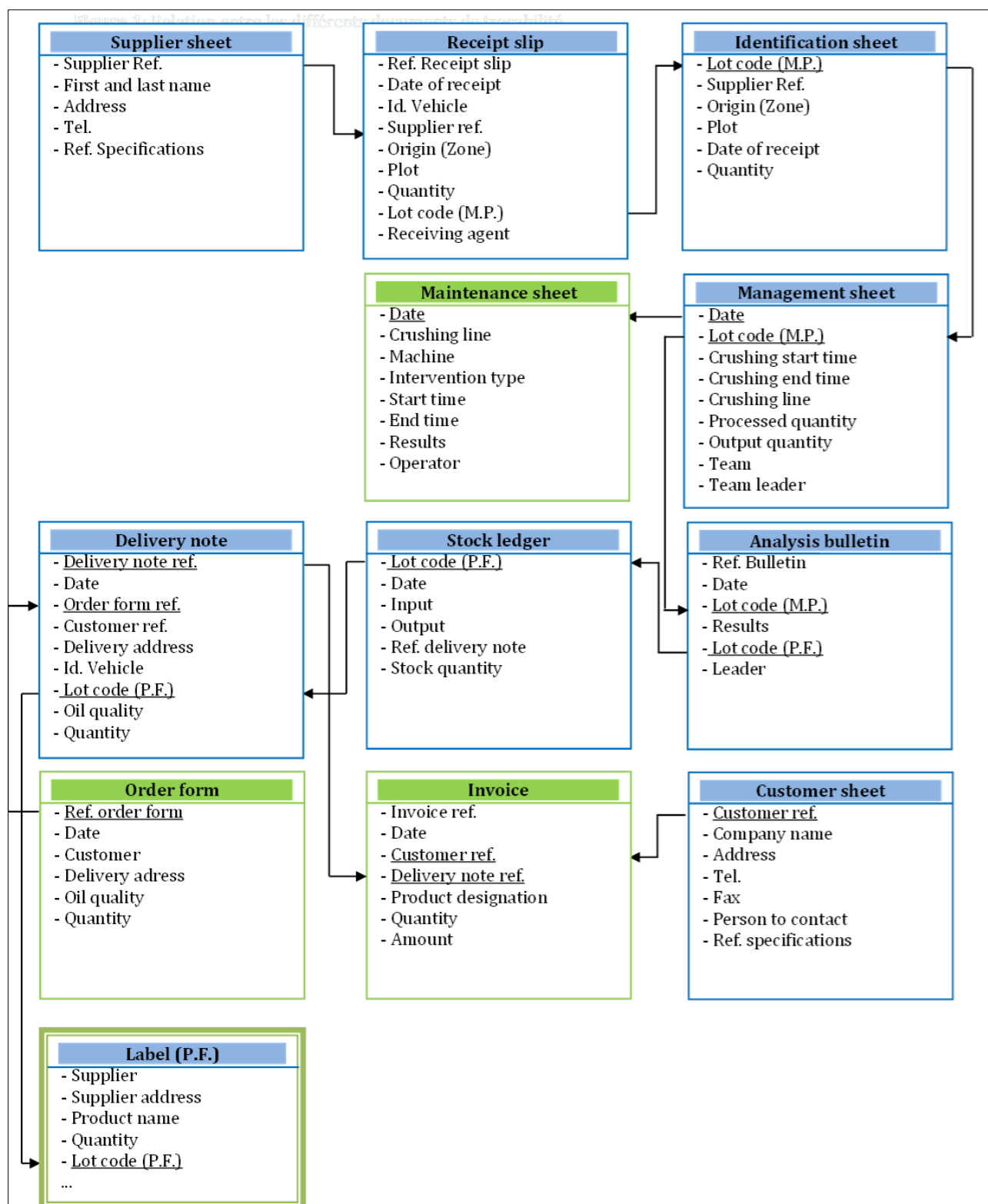


Figure 6 Relationship between different traceability documents

4. Discussion

The study carried out on the implementation of a traceability system for a cottonseed oil production unit: the case of COTRAF SA in Korhogo revealed a strategy for conducting and managing COTRAF's activities. These activities stem from different levels of cottonseed oil production management. In fact, the results of the study revealed the non-existence in this company of certain real indicators of a traceability system emanating from standard organizations.

In addition, the results revealed the organization of COTRAF's production activities in Korhogo, from the reception of cotton seeds to the delivery of final products to the various customers. The results of the study showed that COTRAF does not have a special section dedicated to product traceability. However, their functional organization produces acceptable results thanks to the indicators present, which represent 59.32% for cottonseed oil consumption, as it complies with the rates set by the standards for physico-chemical quality, and in addition, there are parameters which are mostly in conformity with those established by CODEX and CODINORME. These include the definition of objectives, which accounts for 83.33% of standards, and the identification of existence. The visualizations obtained from the RADA and PARETO diagrams show that COTRAF has significant shortcomings in the organization of data management. It represents only 37.50% of the standards and principles required by CODINORME and CODEX ALIMENTARUS. In addition to this highly visible shortcoming, there are the parameters for defining procedures (44.44%) and defining the context (59.33%).

These results are in line with those of (Rombaut, 2015), who carried out a comparative study of cottonseed oil processing in Burkina Faso. Through his results, this author also showed that processing units like NIDOR had no real product traceability system. But their production management was acceptable. In the same vein, the comparative results of physico-chemical analyses at COTRAF were in line with those of SN citec in Burkina Faso, whose results are approved by (Chatigre, 2013), ISO663 (2000), Codex Stan 210 (2003, 2005) and the Burkinabe standard NBF 01-140 : 2009, which stipulates that the physico-chemical properties of a cottonseed oil production unit must comply with the proportions previously defined by this Burkina Faso standard, known as the reference in West Africa.

The difficulty lies in use, which involves several aspects based on a traceability strategy. The traceability documents needed for proper monitoring are not available, nor are the supports for the various operations. COTRAF therefore needs to put in place adequate resources to train a team responsible for the company's traceability. The quality of the oil produced by COTRAF SA is acceptable, given that manufacturing parameters such as impurity levels and humidity are in line with African cottonseed oil manufacturing standards. These results are in line with the instructions set out in ISO 663. 2000. According to this standard, in the production of edible oil, basic properties such as impurities must be observed before declaring it fit for consumption.

The results showed that COTRAF SA has no product coding procedure. The lack of an input/output coding system makes it impossible to retrieve information on the oil produced. The lack of coding is currently a major concern. Based on this observation, the results show that a coding procedure for COTRAF's products has been drawn up according to the different stages of cottonseed oil crushing, the storage method, the team and the production lines. The model is adapted to the realities of the company and takes into account information useful to customers. In order to implement a traceability strategy, it was necessary to establish and define codes to identify the various products within COTRAF. The coding system preceded by the definition of the scope of application shows that the raw material and the finished product are tracked and controlled at every level.

This result is in line with those of Samb et al (2009) and Lebailly et al (2012) who carried out their various studies in Côte d'Ivoire on the guide to good practice in traceability in the cashew nut sector. During these studies, they highlighted one of the first concrete steps to be defined in the implementation of a procedure of good practice in the traceability of agricultural products, codification. In the same vein, the United Nations Industrial Development Organization (UNIDO, 2007), in its CHEFCHAOUEN pilot project, argues that marking the traces of each activity carried out in olive oil crushing must begin with a coding logic, while considering the requirements of the fields of application.

With regard to the traceability scheme developed, the results show that the implementation of a traceability strategy is important for the COTRAF cottonseed oil crushing company in Korhogo. Indeed, in order to meet the company's short and long-term objectives, as well as improve its performance, it is essential to implement a traceability scheme, which is a veritable management tool for tracking all COTRAF's activities. The study elucidates that the proposed traceability schemes take account of information flows, the useful form and the necessary media. All this detail has been done to control products from upstream to downstream, with the aim of building customer loyalty and gaining advantages in the consumer market. This finding is like that of (SN Citec, 2015), who, following work on traceability, asserts that

traceability is a competitive tool in the market and vis-à-vis competitors, as it has given them greater credibility and advantages with consumers.

5. Conclusion

At the end of this study, it was found that the COTRAF company in the Korhogo department is a cottonseed oil production unit using cottonseed from four suppliers in various localities. These are COIC (major supplier), SECO, IVOIRE COTON and CIDT. The lack of a traceability system is evidenced by the absence of product coding procedures at supply and delivery level. The RADA and PARETO diagrams show that COTRAF's organization is 59.32% compliant with the standards and prerequisites required to set up a traceability system. This company does not have a tracking and coding system to enable traceability of the oil produced. However, the company's organization is justly up to scratch, with physico-chemical parameters complying with production standards. Processing procedures are generally respected. The definition of codes and the traceability scheme for this company has been carried out to improve the company's management.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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